SILVACO

MaskViews

User's Manual

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Style Conventions		
Font Style/Convention	**Description**	**Example**
•	This represents a list of items or terms.	• Bullet A • Bullet B • Bullet C
1. 2. 3.	This represents a set of directions to perform an action.	To open a door: 1. Unlock the door by inserting the key into keyhole. 2. Turn key counter-clockwise. 3. Pull out the key from the keyhole. 4. Grab the doorknob and turn clockwise and pull.
→	This represents a sequence of menu options and GUI buttons to perform an action.	**File→Open**
`Courier`	This represents the commands, parameters, and variables syntax.	`HAPPY BIRTHDAY`
New Century Schoolbook Bold	This represents the menu options and buttons in the GUI.	**File**
New Century Schoolbook Italics	This represents the equations.	*abc=xyz*
Note:	This represents the additional important information.	**Note:** Make sure you save often while running an experiment.
NEW CENTURY SCHOOLBOOK IN SMALL CAPS	This represents the names of the SILVACO Products.	ATHENA and ATLAS.

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Chapter 1: Introduction

1.1: What is MaskViews

MASKVIEWS is an IC layout editor designed to interface IC layout with SILVACO's process simulator. It can draw and edit IC layout, store and load complete IC layouts, and import/export layout information using the industry standard GDSII and CIF layout format. MASKVIEWS provides layout information to the simulators, enabling any part of the layout to be simulated. Currently, supported simulators are:

- SSUPREM3: A 1D process simulator. MASKVIEWS provides an array of switches specifying whether each mask is present or absent at any selected point on the layout.
- ATHENA: A 2D process simulator. MASKVIEWS provides a set of mask regions for each layout level giving the start and end points of masks on any arbitrary cross section on the layout. MASKVIEWS also provides information on how ATHENA should construct its grid. It also specifies region names for use with DECKBUILD's **Extract** parameter extraction command and specifies names to be used as electrodes when passing the simulated region on for device simulation.
- OPTOLITH: A 2D lithographic extension to ATHENA. MASKVIEWS provides a 2D set of mask rectangles to be simulated by OPTOLITH (rectangles are generated even if they are not drawn on the layout). MASKVIEWS also allows phase and transmittance values to be specified for each mask element.

MASKVIEWS also provides features to allow layout experimentation such as:

- mis-alignment
- polygon oversizing/undersizing
- global rescales
- region definition — depending on combinations of present mask elements.

Productivity enhancements, such as zoom and pan, full on-line help and manual, and user specific start-up preferences are also available.

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Chapter 2:
Using MaskViews

2.1: Starting

MASKVIEWS can be used directly from DECKBUILD as a support tool, as a stand-alone UNIX or Windows utility, or from within the VIRTUAL WAFER FAB (VWF) environment.

Note: When starting MaskViews for the first time, follow the procedure titled **Starting For First Time in From DeckBuild** paragraph.

2.1.1: From DeckBuild

You can start MASKVIEWS from DECKBUILD by selecting **Tools→Start Maskviews...**. A dialog will appear, which lists all of the layout files in the current directory (if any). You can change the directory name and search string, and you can select a layout file for loading from the list. Clicking on the **Start MaskViews** button executes MASKVIEWS and loads the selected layout file. See "Starting MaskViews With An Example Layout File" on page 2-2 to learn how to load the provided example layout files. The **MaskViews Base Window** (Figure 2-1) appears after a short period.

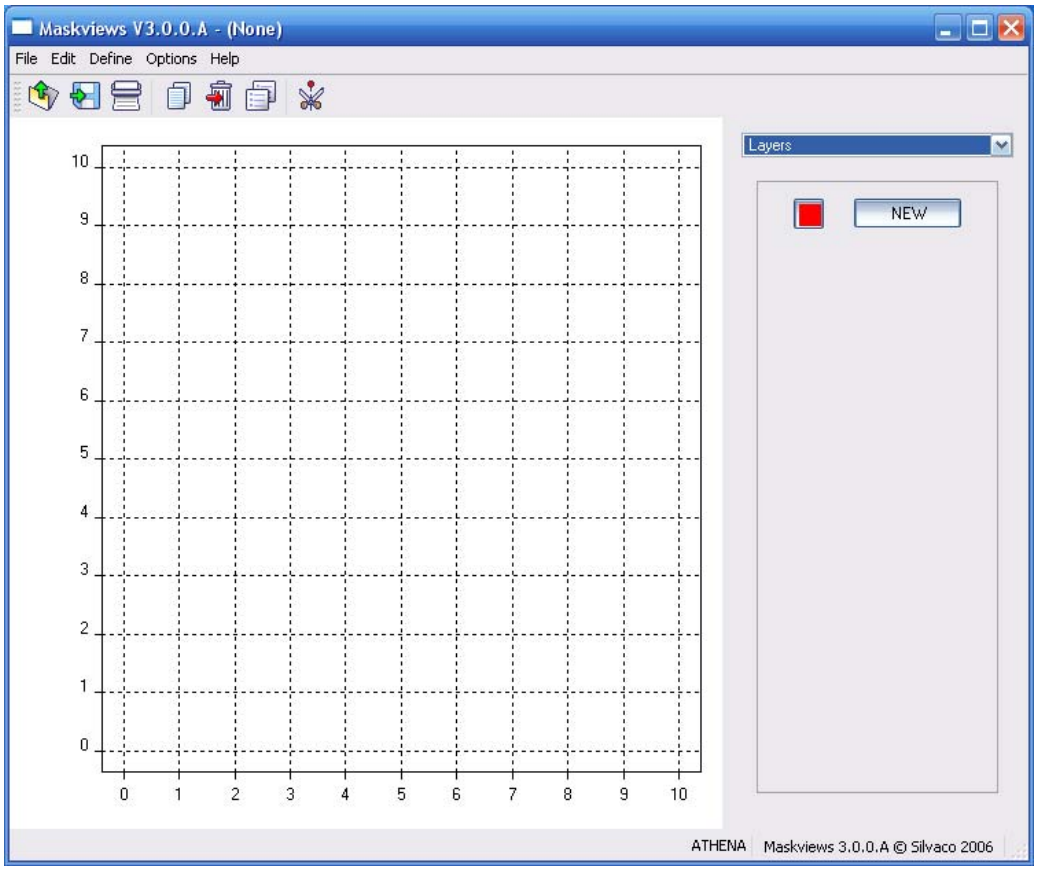

Figure 2-1: MaskViews Base Window

Starting MaskViews With An Example Layout File

If you haven't used MASKVIEWS before, you may find it useful to load and later modify one of the provided example layout files. Examples can be invoked from DECKBUILD's **Main Control** menu. In the following example, a demonstration input deck is loaded into DECKBUILD and a cross-section layout file is copied to the current working directory.

1. To load the demonstration input deck to DECKBUILD, open the DECKBUILD **Main Control** menu and select **Examples**. When the DeckBuild Examples window appears, select **ATHENA: Examples Including Process, Topography and/or Lithography** and a list of input decks will appear.
2. Double click on **anex18.in: Simple CMOS Example Using MaskViews** and a brief description of the input deck will appear. When the `mvanex01.in` window appears, click on the **Load example** button. Observe the example input deck loaded into DECKBUILD text window.
3. Pull down the **DeckBuild Tools** menu and select **MaskViews→Start MaskViews...**.
4. The file "`anex18.in`" should be listed in the filebox of the MASKVIEWS Layout Files dialog. If not, click on **Refresh** and click on **Start MaskViews**. The MASKVIEWS window will then appear.

Interfacing With A Simulator

To load the layout information into **DeckBuild**:

1. Select **File→Write Cutline File** and define a cutline area by clicking on a start point.
2. Click on an end point. This action causes the **MaskViews:ATHENA** cutline dialog to appear. Click on **Write** and observe preview cutline dialog (2D masks from 2.2,11.6 to 7.8,10.9) appears.
3. Pull down the **DeckBuild Tools** menu and select **MaskViews→Cut files...** to observe the **MaskViews Cut Files** dialog. You can then use one of the following methods to load the example cutline file: **Disk Files** or **Drag & Drop**.

To use **Disk Files**:

1. Pull down the **Category** menu.
2. Select **Disk Files**.
3. Select **Load**.

To use **Drag & Drop**:

1. Pull down the **Category** menu and select **Drag & Drop**.
2. Press **SELECT** on the icon in the upper left corner of the preview cutline dialog (2D masks from 2.2,11.6 to 7.8,10.9), then drag it to the **MaskViews Cut Files** dialog window and release.
3. Click on the icon to frame it and click on **Load**. The filename `default.sec.xx` has been loaded, where `xx` is an incremental number, depending upon the number of cross section cutline files in the current working directory.

To load this cutline file into DECKBUILD:

1. From DeckBuild's main window, open the **Tools** menu.
2. Select **MaskViews**
3. Select **Cut files** and specify a file name.

2.1.2: Using MaskViews Inside The VWF

When used within the VIRTUAL WAFER FAB (VWF) AUTOMATION TOOLS environment, some of the operations of MASKVIEWS are made slightly different. To start MASKVIEWS, double click on one of the layout mask items in the **Masks** directory in the VIRTUAL WAFER FAB library section. Layout entries are created using the **Create** option while displaying the **Masks** directory. A layout entry must be present to start MASKVIEWS, even though it may be empty. You can copy a layout entry by starting MASKVIEWS on the destination layout item, then dragging and dropping the source item to the MASKVIEWS layout window. A warning will appear if any mask elements already exist and are deleted by the copy action. The **File** menu is replaced by a **Data** menu, whose purpose is to store the layout back into the database. All of the normal file control facilities are available under the **Data** menu. Selecting this will display a dialog from VIRTUAL WAFER FAB asking you to create the name of the mask data entry. The **Write to deck** options are unavailable when used within the AUTOMATION TOOLS.

2.1.3: Starting MaskViews From The Stand-Alone UNIX or Windows Utility Prompt

To start MASKVIEWS from the Windows or UNIX utility command line prompt, enter:

```
maskviews (command line options)
```

Command line options are a series of switches that causes the initial MASKVIEWS displayed to be set different from the default. File related options take two parameters and are:

- `-d` (`file name`): Sets the output default to the named file.
- `-f` (`file name`): Loads the named layout file.
- `-gds (gds file name cell name)`: Loads the named cell from the given GDSII file.

The following option loads the named ATHENA grid template:

- `-g` (`file name`)

You can also set the default target simulator from the command line using the switches:

- `-suprem3`
- `-athena`
- `-optolith`
- `-clever`

2.2: Main Window

2.2.1: Layout and Functionality

The **MaskViews Base Window** (Figure 2-2) display is composed of up to four sections.

- The **Layout** window is the layout area where all layout and simulation actions are performed. Unless MASKVIEWS was started with a layout file, the layout window is an empty grid.
- The Menu bar is displayed along the top of the screen and contains a series of menus, which are used to control the actions of MASKVIEWS.
- The **Key** panel is displayed on the right side of the window. The key panel has several modes and its function change as the mode is changed.
- The Status Bar is displayed across the bottom of the window. It shows any messages relevant to the current actions.

The filename of the loaded layout file is shown along the top title bar of the window. "NONE" is displayed if no file has been loaded. Whenever you make changes to the layout without saving them, the word "edited" appears in the title bar.

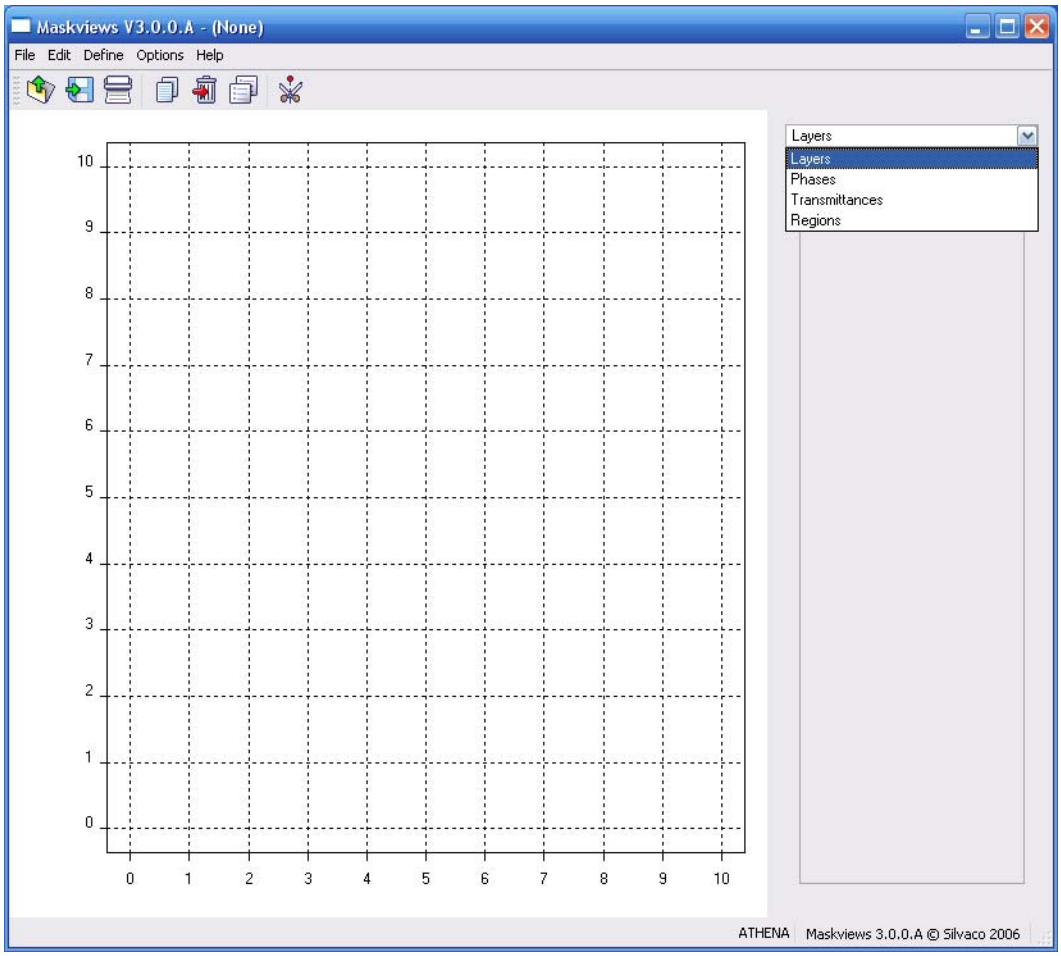

Figure 2-2: The Mode Menu of MaskViews Base Window

Control Panel

Commands are performed by selecting the appropriate option from one of the following menus.

- **File** contains a menu of file functions, print functions, and the empty (or delete all) function.
- **Edit** contains all of the polygon edit commands.
- **Define** lists all of the layout, screen, and object definition options.
- **Options** contains optional utilities such as zoom and pan.
- **Help** contains help related functions such as the on-line manual and version information.

Key Panel

There are four object display modes in MASKVIEWS: **Layers**, **Phases**, **Transmittance**, and **Regions**. These are selected from the menu at the top of the key panel.

- **Layers** — The layout levels in the structure are displayed. The current edit layer is chosen by selecting the layer name from the list. Levels are made visible/invisible by selecting/deselecting the layer key item next to the layer name. Selecting a layer while holding down the SHIFT or CONTROL keys causes all other layers to be disabled or enabled respectively. If the number of layers in the layout becomes too great to be displayed down the side of the screen, then only some of the layer keys are shown. Nudge up and down buttons are then displayed, allowing the layers keys which are to be shown to be scrolled up and down.
- **Phases** — The layout screen displays masks from one level only. The key panel shows phase shift values for each mask on this level. The current default phase shift value used for editing is set by selecting an item in the key, or by adjusting the phase value slider below it.
- **Transmittances** — This mode is similar to the **Phases** mode except the key and the display show mask transmittance values.
- **Regions** — This shows regions that have been set up in the **Region definition** dialog. All polygons are outlined only on the screen but can still be edited. The current edit layer is chosen by selecting the layer name from the menu on the key panel. Regions are enabled/disabled by selecting the **key** button next to the region name. Regions are features of the layout that can be identified using layer combinations. For example, device gate regions are areas where polysilicon overlaps active areas.

2.3: Editing

2.3.1: Defining Edit Parameters

Selecting Screen from the Define menu presents the **Screen** dialog (Figure 2-3).

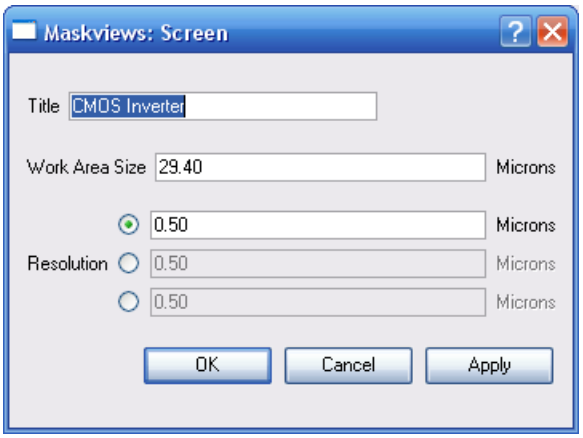

Figure 2-3: Screen dialog

This dialog is used to set the following screen parameters:

- **Title** — Sets a title string that will be displayed at the top of the layout and on any hard copies.
- **Work Area Size** — Sets the size (in microns) of the total layout area.
- **Resolution** — Specifies the resolution to which all draw, edit and simulator actions are rounded. Three input fields are available to specify the resolution. The check box next to each is used to define what is currently active. This allows easy selection of different resolutions for different types of work.

The values specified in these fields are stored in the layout files. These can be set to different values depending on the simulator selected. They cannot be stored as defaults. See Section 2.7.2: "Default Preferences" for a description of the other options that affect layout and editing on the screen.

2.3.2: Defining Layout Layers

IC layout descriptions within MASKVIEWS are specified in terms of polygons that exist on a number of layout layers, each of which corresponds to a reticle mask used in the IC fabrication process. Layers are defined by using the **Layers** dialog (Figure 2-4) displayed by selecting **Define→Layers...**.

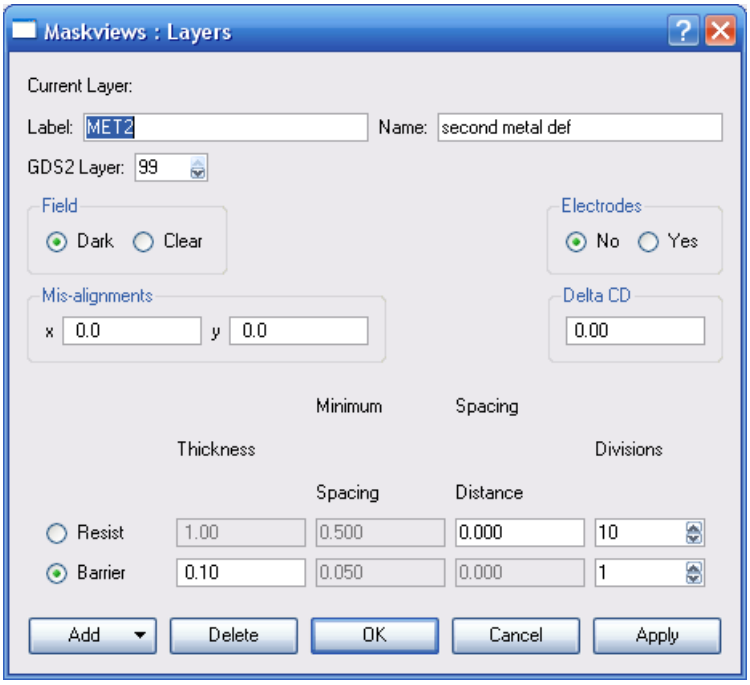

Figure 2-4: Layers dialog

The values displayed in the dialog relate to the attributes of the current edit layer. The current edit layer can be changed by selecting a new layer name on the key panel. You must press the **Apply** button after changing values in the Layers dialog. The **Layers** fields are the following:

- **Label** — This field provides a short abbreviated (five character) name for the layer, which is used on the key canvas and to identify the layer on any generated outputs.
- **Name** — This field contains a more complete descriptive name for the layer.
- **Field** — This field indicates whether the mask reticle is a dark or clear field. Dark field layers consist of holes cut into an opaque reticle. Clear field layers have opaque mask elements on a transparent reticle. The field value is used when writing mask output to determine if a present mask polygon corresponds to the presence or absence of mask material.
- **Mis-alignment** — These fields (x and y) are used to offset a complete mask layer in the horizontal and vertical directions. This can be used to experiment with the effects of accidental or deliberate mask mis-alignment.
- **Delta CD** — This field value is used to bloat or shrink mask elements by the value specified. Entering a value causes the sides of the each element to move outwards in inwards by the difference between the old value and the new value. If the **field** attribute is **Clear**, then a positive change causes the elements to bloat. A positive change causes the elements to shrink if the field is **Dark**.
- **Add** — New layers are added by selecting one of the options available under the **Add** button. The new layers can be inserted before or after the current edit layer.
- **Delete** — The current edit layer can be deleted by clicking on the **Delete** button. A warning message is displayed if the layer currently contains polygons.

If the target simulator is set to ATHENA (see Section 2.7: "Preferences"), the following additional items are displayed on the dialog.

- **Electrodes** — This item is used to indicate that the current layer is a conducting layer and mask label names used will be passed onto the simulator as electrode names.
- **Thickness** — Deposited mask material thickness is specified in the thickness field, and its material type can be set to either **Resist** or **Barrier**. This information is used with the ATHENA `deposit` statement (see the ATHENA USER'S MANUAL) to form the masked layer. If the target simulator is set to SSUPREM3, then the resist thickness can again be specified but its type cannot.

Selecting **Define→Biases...** makes an alternative method of accessing the Delta-CD values available. The bias value listed in this dialog is identical to the Delta-CD value listed in the layers dialog. You can load the complete set of biases/Delta-CD's by selecting **File→Open**. You can save them by selecting **File→Biases...**.

2.3.3: Defining Labels

MASKVIEWS allows you to create labels in any layer at any location on the layout through the Labels Editor. To open the Labels Editor dialog (see Figure 2-5), select **Define→Labels...**.

Note: The **Define→Labels** feature is only available when you use MASKVIEWS with ATLAS, CLEVER, and VICTORYCELL.

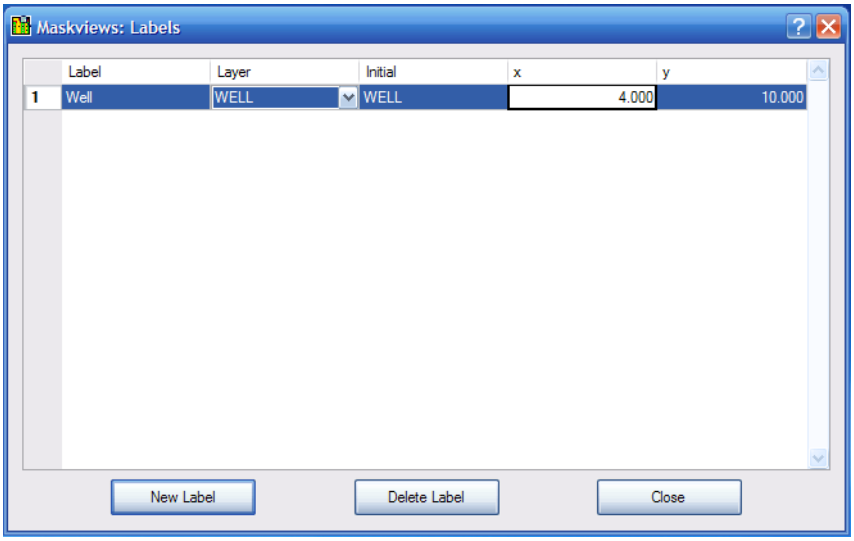

Figure 2-5: Labels Editor dialog

The Labels editor maintains a list of the labels that you already defined while also giving you the options of adding a new label, deleting a label, or changing an existing label. The Label editor fields are:

- **Label** — This field allows you to enter the text (up to eighty characters) of the label. If the label text exceeds twelve characters, only the first ten characters followed by an ellipsis will be displayed in the labels list. The actual label, however, will not be truncated unless it is over 80 characters long.
- **Layer** — This field allows you to select the layer in which the label will be placed.
- **x pos & y pos** — These fields allow you to define the labels location on the layout.

The Label Editor buttons are:

- **New Label** — Clicking on this button will create new labels. To add a label, simply enter the desired label text, layer, and x-y coordinates into the appropriate fields and the click on the **New Label** button. The only restriction is that the label text cannot be empty. If the label text is empty, no action is taken. Otherwise, the new label is placed on the layout and at the end of the label list.
- **Delete Label** — Clicking on this button will delete the existing label. To delete a label, select that label from the list and click on the **Delete Label** button. If there are no labels, the **Delete** button is inactive.
- **Close** — Clicking on this button closes the Labels Editor dialog.

The Labels Editor is not to be confused with the **Label** option found in the **Edit** menu. The **Label** option from the **Edit** menu can only place labels at the upper left hand corner of a polygon. Each label must be associated with a polygon. Each polygon can have at most one label. The Labels editor found in the **Define** menu can place labels anywhere on the layout and these labels are not attached to any polygon. Both types of labels, however, are attached to the layer in which they exist (i.e., deleting the layer also deletes the labels within that layer). The Labels Editor from the **Define** menu does not keep track of the labels created with the **Label** option from the **Edit** menu.

2.3.4: Drawing Objects

All masks objects used inside MASKVIEWS are polygons, which may be irregular and contain up to several hundred sides. Most drawing and editing is performed in terms of polygons. Facilities, however, are provided to allow you to draw in terms of more regular shapes. The **Objects** dialog (Figure 2-6) controls the current shape drawing mode. To display this dialog, select **Define→Objects...**. The **Object** field on this dialog indicates what type of shapes are to be drawn on the current edit layer. Initially, three options will be available: **polygon**, **stick**, and **serif**.

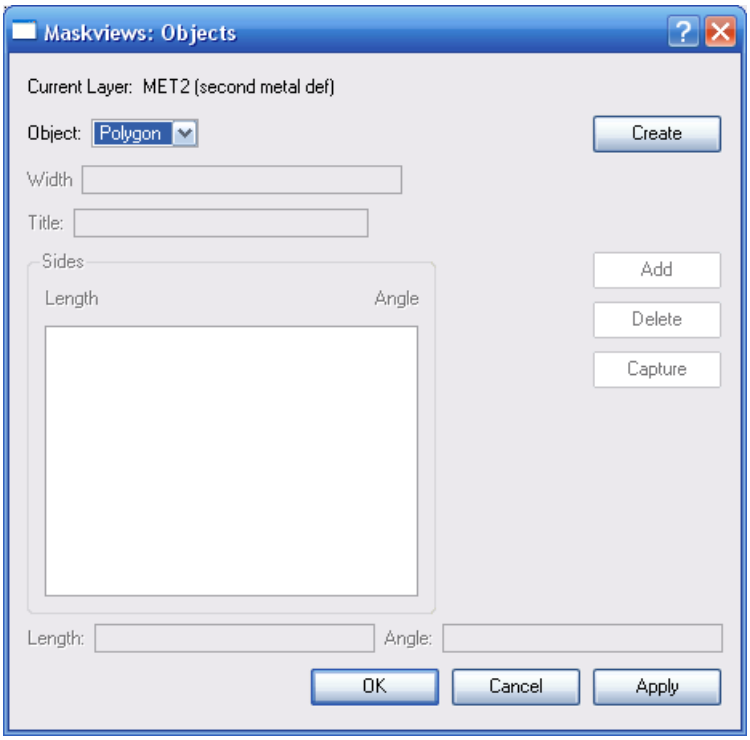

Figure 2-6: Objects dialog

Polygons

When the object type is set to **polygon**, the mask objects are drawn as multi-sided polygons of any shape. A polygon is drawn by selecting the vertices of the polygon on the main layout screen. After the selecting first vertex, a line will be drawn connecting the most recent vertex with the current mouse pointer position.

A polygon is completed either, by closing the polygon path, by selecting the first point on the path again as the last point, or by selecting the **Edit→Close path**. You can cancel polygon drawing any time before the path is completed by selecting **Edit→Cancel**. Polygon drawing obeys the rules for resolution spacing set up in the screen definition dialog, and the angle constraint rule set up in the Preferences dialog. If you use the **Close path** option to complete a polygon, then the drawn path from the last selected vertex to the first vertex also obeys these rules, which may cause extra vertices to be added.

Sticks

Sticks are used to draw single line polygons. Sticks are constructed by selecting the start and end points of the stick on the main layout screen. A stick is drawn along the line joining the two points with a diameter as specified in the **Width** field of the objects dialog and a shape as specified in the **Type** field. Three stick types are available:

- **Butted** — The end points of the stick exactly coincide with the end points of the drawn line. The stick is still rectangular.
- **Extended** — The end points of the stick overshoot the end points of the drawn line by half of the diameter at both ends. The stick is still rectangular.
- **Rounded** — The end points of the stick overshoot the end points of the drawn line by half of the diameter at both ends. The ends of the stick are round.

Sticks are converted to polygons as they are drawn. You cannot alter the width, type and position of the stick once you draw the stick. You can cancel stick drawing before specifying the end point by selecting **Edit→Cancel**. Stick drawing obeys the rules for resolution spacing and angle constraint. If you use MASKVIEWS with the OPTOLITH simulator, then a warning message will be displayed if the stick diameter selected cannot be correctly quantized with the specified resolution.

Serifs

Serifs are small squares that are added to masks to sharpen the corners of the mask when it is projected and exposed on the semiconductor substrate. When in this drawing mode, a single click places a square with each side specified by the **width** field centered at the mouse click position. Once serifs are placed, their size cannot be changed. The serif size set here is also used as the size for serifs when added using the **Add serifs** edit menu option (see Section 2.3.6: "Polygon Editing").

2.3.5: User Defined Objects

User defined objects allow any polygonal shape to be drawn on the current layer by specifying the path in terms of distances and angles. The shape is then drawn by selecting the first **Vertex** point of the shape on the main layout window. User defined objects are created by selecting the **Create** button on the Objects dialog. This is then appended to an object titled new to the end of the objects list. Once you select the object as the current object type, you can enter a more descriptive name for the object in the **Title** field of the dialog. Sides of the shape are described in terms of angles and lengths, which are listed in the scrolling list on the Objects dialog. The angle value specifies a rotation to the path direction to be applied before drawing the side. The initial angle is vertically upwards on the screen, and angle values are in degrees clockwise. For example, the length and angle pairs (1,0), (1,90), (1,90), and 1,90 define a unit square, which could be used to define contact holes on the layout.

The length of each side is determined by the side length parameter multiplied by the object dimension parameter. Therefore, you can create similar polygons of different sizes by changing the dimension parameter only. The polygon path is always closed even if the first and last points in the list do not coincide. You can add extra sides after the current side by selecting the **Add** button on the Objects dialog. You can delete sides by selecting the **Delete** button.

You can encode objects already drawn on the layout screen as user defined objects by clicking on the **Capture** button on the Objects dialog and selecting the desired polygon on the layout. The drawn polygon must be on the current edit layer. The object is then encoded so that it will be redrawn again with exactly the same size if the current dimension value is used.

User objects are converted to polygons as they are drawn. Once drawn, their original attributes are lost and cannot be altered. User objects do not obey the rules of resolution or angle constraint. Any shape can be drawn, some of which may not be totally suitable for the simulator being used. User object placement does conform to the resolution spacing. A library of useful shapes (e.g., circles or octagons) has been installed in the `$SILVACO/var/maskviews` directory.

2.3.6: Polygon Editing

The **Edit** menu contains command options used during the edit stages of creating MASKVIEWS layouts. The options are:

- **Cancel** — Aborts the current edit action before any changes are made.
- **Move** — Allows a polygon to be moved. Select and drag the desired polygon to its new position and release the mouse button.
- **Copy** — Allows a polygon to be copied. Select and drag the desired polygon to the new position and release the mouse button.
- **Invert** — Mirrors a polygon on the current edit layer, this can be either horizontally or vertically.
- **Mask** — Allows attributes for individual mask elements to be altered. For individual mask elements, after selecting, point and click on a mask element on the current edit layer. If the edit mode is **Phases** or **Transmittances**, then the respective values for the element can be altered using the items on the key panel (described in more detail in Section 2.3.7: “Object Editing”). For a group of mask elements, draw a selection rectangle around the mask elements you wish to alter on the current edit layer. You can then alter **Phase** or **Transmittance** values as you would for a single mask element.

If the edit mode is **Layers**, then a dialog is displayed as shown in Figure 2-7. This allows the element to be moved to a different layer or resized or both by the specified amount. Clicking on the **OK** button puts the changes into effect.

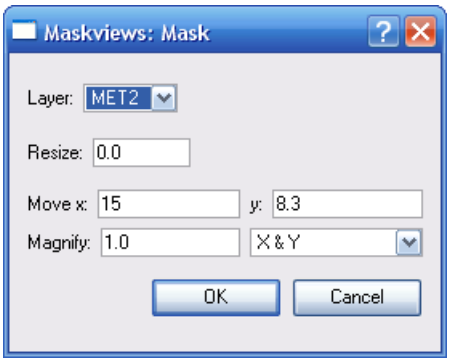

Figure 2-7: Mask Alter Attributes dialog

- **Label** — Attaches labels to polygons for use as electrode names. A dialog is displayed with a text field requesting label name once a mask object has been selected. This dialog also contains a checkbox enabling/disabling the whole layer as a layer of electrodes. This option copies the electrode definition from the Layers dialog.
- **Close path** — This is used to complete a partially drawn polygon.
- **Group** — These options are used to **cut** and **paste** sections containing many polygons in single actions. After selecting the **cut** or **copy** options, an area of the layout is marked by selecting opposite corners of a "rubber-band" box. Polygons contained either partially or wholly within this box are then copied to the group paste buffer. If the **cut** option was chosen, these polygons are also removed from the layout screen. After choosing **paste**, the drag operation can be used to position the group paste buffer back onto the layout screen. The **undo** option can be used to undo a **cut** or a **paste** operation, as long as no other actions have been performed since the operation.
- **Slice** — Cuts all polygons along a line into sections. After selecting, a line is drawn on the screen and after the second point has been defined all polygons along the line is sliced. This can be used to assign more than one electrode name to a given polygon. If you cut a polygon, its labels are then discarded.

2.3.7: Object Editing

- **Merge** — This is used to merge two overlapping polygons into one shape. After selecting **Merge**, two polygons are chosen for merging. A warning message is displayed if the polygons cannot be merged correctly. The merge operation uses only the outside surfaces of the merged polygons, any totally enclosed spaces are lost.
- **Mode** — These options are used to select whether all drawing actions create new polygons or cut holes in current objects. If you select **draw outline**, then all drawing operations create new mask objects. If you select **cut hole**, then drawing operations are used to cut holes in existing objects. In order for hole cutting to succeed, all vertices and all sides of the cut polygon must line within the existing mask object.
- **Electrode** — For certain simulator modes, this allows electrodes to be specified by defining two end points. After selecting the option, select two point for the electrode. If the two points differ in by X and Y coordinate, a rectangular electrode is generated. Otherwise, a straight line electrode is formed. In both cases, the electrode end points move to coincide with vertex points of the closes polygon.
- **Auto label** — Selecting this option attempts to automatically label polygons with labels loaded from a GDSII file. Polygons are automatically labelled if a label position lies within the polygon and the polygon does not already have a label.
- **Add serifs** — Adds small square serifs at all vertex points of a selected polygon. After selecting this option, select a polygon for the serifs to be added to.

Note: Serifs can not be added to serifs.

- **Undo** — When enabled from the **Preferences** section (see Section 2.7: "Preferences"), this allows you to cancel the most previous `edit` command. Once you perform an **undo**, the option becomes unavailable until a further edit action occurs.
- **Delete** — Erases a mask object.

2.4: Simulator Control

MASKVIEWS's main function is to provide process simulators with layout data, enabling any point on a real layout to be simulated without having to manually calculate mask edges. MASKVIEWS can either write a summary file for later use (either by DECKBUILD or the simulator directly), or can modify an existing simulator input deck with the statements required to perform the masking actions. To open the dialog that controls the output destination, select **File→Output...**. The dialog contains a list of all files in the current directory matching the **Filter** field. The **Write To deck** option is used to select the type of output to be created. If set, then the file named in the **File** field must be a valid simulator input deck. The output is then a modified version of this deck containing the mask information. If **Write To Deck** is not set, then the output file written only contains the mask information and no input file will be required. The output file name has a unique integer number appended to prevent overwriting existing files.

2.4.1: SSUPREM3

When you set the target simulator to SSUPREM3 (see Section 4.3: "Invoking DeckBuild" in the DECKBUILD USER'S MANUAL), MASKVIEWS generates a 1D set of mask elements corresponding to a single point on the layout. After selecting **File→Write Cutline File**, you can select a single point on the layout and the output will be written.

The input deck should be a valid SSUPREM3 deck with the line

```
mask = "abbreviated_layer_name"
```

added where mask information is required. The abbreviated layer name should be one of the names shown on MASKVIEWS key panel. If a mask polygon is present on the layer at the point and the layer field attribute is set as **Clear**, then the line:

```
deposit photoresist thickness={value}
```

is inserted in the deck at this point. The photoresist thickness value inserted is the value specified in the layers **definition** dialog. The `deposit` statement is also inserted if no masks are present and the field is **Dark**. A `strip` statement can be used later in the deck to remove the photoresist. If the statement:

```
mask = "abbreviated_layer_name" reverse
```

is found in the deck, then the effect of the field attribute is reversed. A **Cutline/section** for use with DECKBUILD is written after a point on the layout has been selected. A summary mask display is shown if the **Display masks** preference has been set. An information message will appear indicating the name of the output file written.

2.4.2: ATHENA

If you set ATHENA as the target simulator, MASKVIEWS generates a series of etch regions along a line corresponding to the presence and absence of mask elements at those points on the line. After selecting **File→Write Cutline File**, the two end points of the simulated section are selected on the layout.

If you enable the **Cutline edit** preference, a dialog will appear showing the coordinates of the selected line and three buttons labeled **View**, **Write**, and **OK**. The selected line remains on the layout and can be moved by selecting new end points on the layout. The nearest current end point to the new selected point will be moved. The **View** button is used to draw a summary display of the masks along the line. **OK** cancels the write file operation. Click on **Write** to write output. If the **Cutline edit** preference is not enabled, the output is written once the second end point is selected.

The **View** button has two options (**Full Grid** and **Edges Only**) that allow you to modify the grid display. If you select **Full Grid**, a summary display will appear with the initial grid lines that are generated by ATHENA. If you select **Edges Only**, grid lines that coincide with mask edges are displayed.

Note: You should enable grid display and specify an appropriate display mask value in the Preference dialog before attempting to modify the grid display using the **View** menu options.

If you set the **Request Filename** preference, you must specify the name of the output file. If **Cutline edit** is enabled, then an extra field labelled **Filename** is available to specify the name. If **Cutline edit** is disabled, then a dialog is displayed requesting the output file name after the second cutline point has been selected. You can alter the values of the coordinates on the end points of the cutline by changing the values shown on the **Cutline edit** dialog.

The input deck should be a valid ATHENA deck with the lines

```
mask = "abbreviated_layer_name"
```

added where mask information is required. The abbreviated layer name should be one of the names shown on MASKVIEWS **key** panel. At runtime, DECKBUILD replaces this line with:

```
deposit photoresist thickness={value}
```

or with the line:

```
deposit barrier thickness={value}
```

The material type and thickness written are those defined in the Layers dialog. The `deposit` statement is then followed by a series of `etch` statements. A region to be etched is any area not containing a polygon mask on a clear field layer or any area containing a mask on a dark field layer. The `etch` statements will appear similar to:

```
etch photoresist start x = {start of region} y = -20.0
etch continue x = {end of region} y = -20.0
etch continue x = {end of region} y = 20.0
etch done x = {start of region} y = 20.0.
```

If the statement:

```
mask = abbreviated layer name reverse
```

is found in the deck, then the effect of the field attribute is reversed. If you disable **write to deck**, an information file for use with DECKBUILD will be written after selecting both points on the layout. A summary mask display will appear if you set the **Display masks** preference. You can load the cutline directly into DECKBUILD by dragging the icon displayed in the top corner of the summary. See Section 2.7.5: "Drag and Drop Preferences" for more information. An information message will appear indicating the name of the output file written.

Grid Definition

MASKVIEWS also controls the initial grid generation statements for ATHENA. Definition of the grid control parameters is done using the grid control dialog (Figures 2-8 and 2-9) displayed by selecting **Define→Grid→x...** and **y...**. The **Horizontal grid** dialog shows the grid definition parameters for the current edit layer and a list of all layers in the layout. Layers must be enabled in the list to have any affect on the grid.

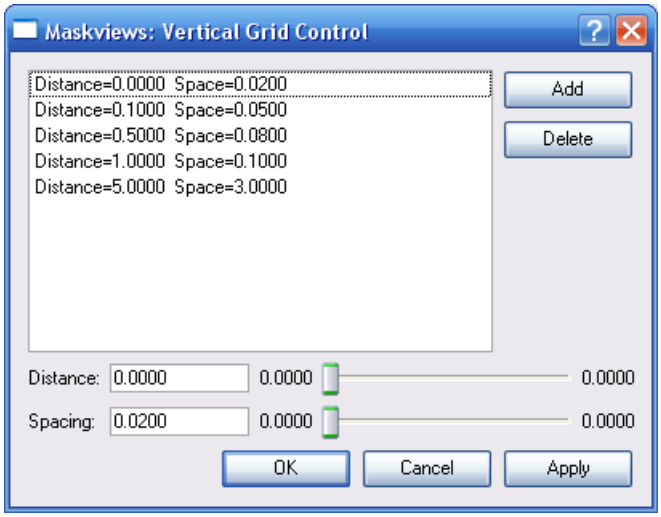

Figure 2-8: Vertical Grid Control dialog

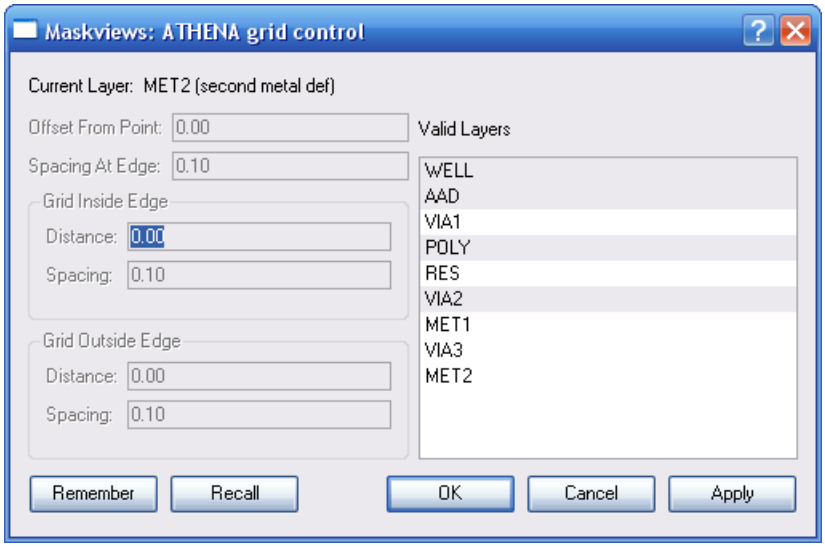

Figure 2-9: Horizontal Grid Control dialog

The **Remember** and **Recall** buttons on the **X grid definition** dialog allows the grid spacing parameters for single layers to be remembered and recalled for later use. Clicking on the **Remember** button stores the currently displayed settings of spacing parameters to memory. Clicking on **Recall** restores values to the dialog from memory. These can be used when temporarily changing values to observe the effect of spacing or to copy spacing values from one layer to another.

Grid definition in ATHENA consists of a series of statements:

```
line x loc={location} spac={spacing}
```

which defines grid spacing at a specific location. MASKVIEWS generates line statements for each mask edge on enabled layers. ATHENA requires a grid line to be present at an etch point. It can also specify spacing points inside and outside of the mask region (Figure 2-10). This allows fine grids to be created where known mask edges lie decaying to courser grids at some point further away.

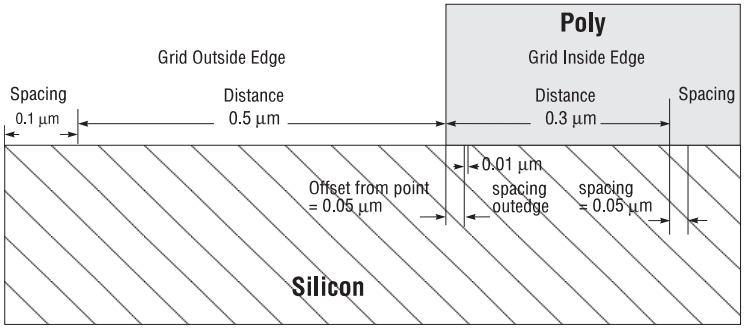

Figure 2-10: Horizontal Grid Spacing Parameters

The **Vertical grid** dialog allows vertical distance and spacing lines to be modified using the **Distance** and **Spacing** slides. To add a line to the list, click on the **Add** button. To remove the currently selected item, click on **Delete**. The list is automatically sorted by increasing distance. If you enable the **cutline edit** mode, the Cutline dialog will contain a maximum depth field, which you can use to specify the largest line y distance. If **write to deck** is not enabled, grid information is written to the output information file in a form readable by DECKBUILD.

Layout Experiments

Layout experiments can be performed with ATHENA decks using the **Loop variables** dialog (Figure 2-11) displayed by selecting **Define→Looping...**. This allows mis-alignments and delta cd values to be ramped across ranges to create matrices of input decks.

To enable a variable, use the check-boxes along the left side of the dialog. You can then enter the layer name, parameter, start, step, and number of steps values for that variable using the displayed fields. A warning message will appear if you use a layer name/parameter combination as more than one variable. The write file sequence is the same as when looping is not active, except many files are generated. If you enable the **Mask Display** preference option, masks sets will appear for all the loop points.

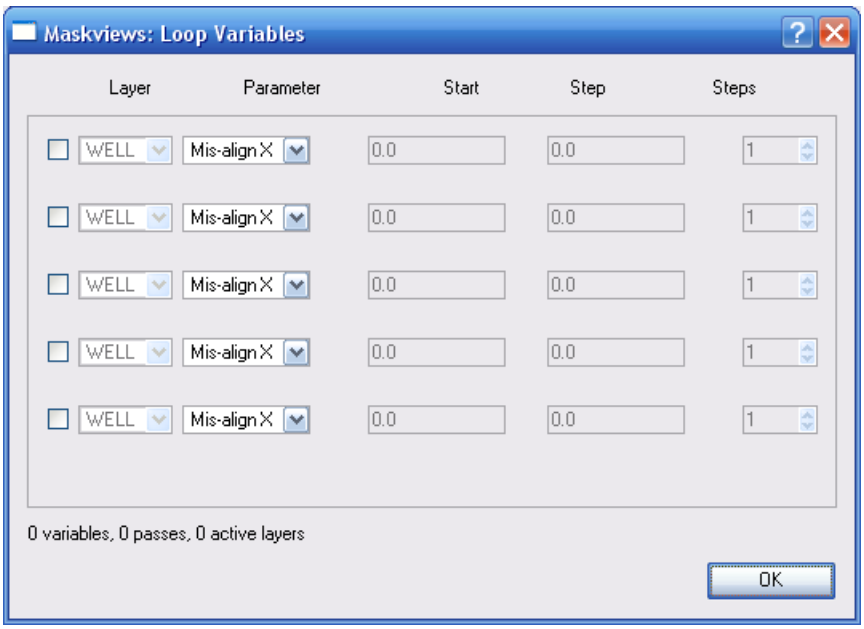

Figure 2-11: Loop Variables dialog

2.4.3: OPTOLITH

If OPTOLITH is set as the target simulator, the output consists of a series of 2D mask elements taken from one of the layout layers. The OPTOLITH module of ATHENA works with rectangular elements only and any layout is converted to rectangles before the output is written. Therefore, it is advised that the 90° only angle constraint preference is used when targeting MASKVIEWS for OPTOLITH (sloped lines will be converted to a series of steps). As the OPTOLITH module simulates only masks from one layout layer and is interested in phase and transmittance values for each mask element, it is most useful to use either the **Phase** or **Transmittance** edit modes when OPTOLITH is the target simulator.

When you select **Write file**, a dialog will appear that shows the coordinates of opposite corners of the simulation area (initially both will be blank) and the name of the output file to be written. The corners of the simulation area are selected by pointing to the location on the layout display and pressing the left mouse button. After selecting the first corner, a “rubber band” box will be drawn from its location to the current mouse pointer location showing the region to be simulated. Once you define the second corner, two more buttons will appear on the dialog.

- **Write** — Writes the mask element rectangles to the file specified in the **Filename** text field. Enter a new name in this field if the desired output file name is different than the one indicated.
- **Abort** — Cancels the write file mode and dismisses the dialog.

Phase and Transmittance Values

The OPTOLITH photo-lithographic simulator has the ability to simulate the effect of mask elements with different phase and transmittance values. MASKVIEWS provides the facility to edit these attributes on mask elements using the special modes selected on the key panel. When you select one of the two modes, mask polygons from one layout level only will appear with their phase or transmittance values indicated by colors listed in the key. To edit the attributes of a mask element, first select **Edit→Mask**, then point and click to the mask element that needs to be edited. All other elements on the screen are then re-drawn in a dimmer color and the key buttons and sliders are updated with the mask element's phase and transmittance attribute values. You can alter the values for the selected mask by moving the sliders or selecting a new value from the key buttons. Once you set the correct value, you can resume normal editing mode by selecting **Edit→Mask** and clicking on an empty space on the layout area.

Phase Display Mode

The layout screen displays masks from one level only. The key panel shows phase shift values for each mask on this level. The current default phase shift value used for editing is set by selecting an item in the key or by adjusting the phase value slider below it.

Transmittance Display Mode

This mode is similar to the **Phases** mode except the key and the display show mask transmittance values.

Serifs

If serifs have been applied to a polygon, they alter the mask image for that polygon when it is written to the file. Serifs added to convex vertices (i.e., outside corners) add their area to the shape of the polygon, while serifs added to concave (i.e., inside corners) vertices subtract their area.

2.5: Files

2.5.1: Loading and Saving Files

All of the data stored in MASKVIEWS can be saved or loaded. To load files, select **File→Open... dialog** (Figure 2-12).

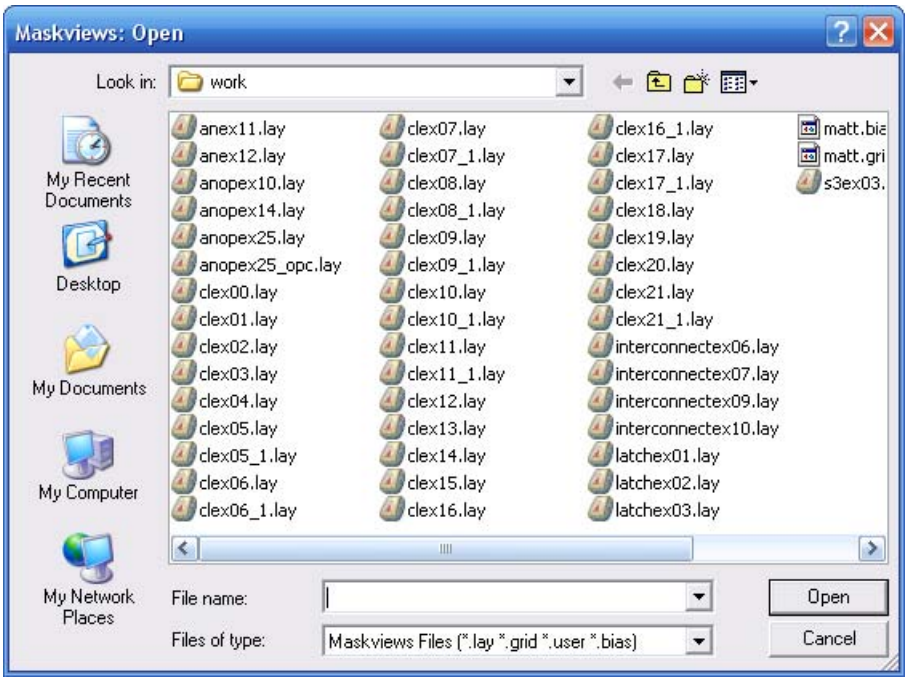

Figure 2-12: Open dialog

This dialog contains a list of all files that match the current filter. You can change the filter by using the **Files of type** combo box at the bottom of the dialog. You can change the current directory using the Look In combo box at the top of the dialog, along with the buttons to the right of it.

Files in MASKVIEWS are saved using following menu items:

- Selecting **File→Save As...** (Figure 2-13) is for saving layout data.
- Selecting **File→Save Grid...** (Figure 2-14) is for saving SSUPREM4 grid template data.
- Selecting **File→Save Objects...** (Figure 2-15) is for saving user defined polygons.
- Selecting **File→Save Biases...** (Figure 2-16) is for saving mask biases.

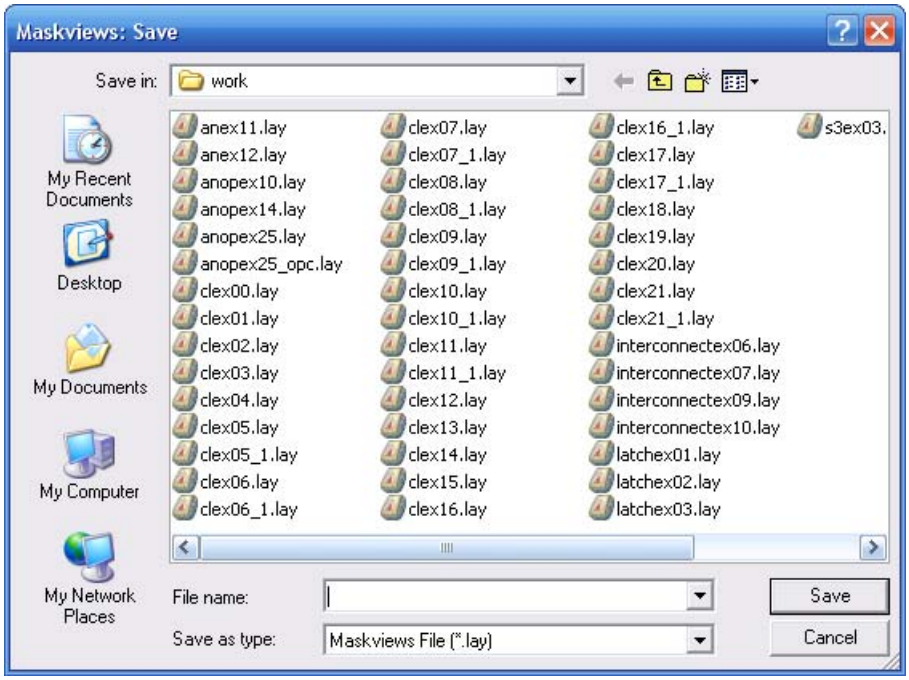

Figure 2-13: Save dialog

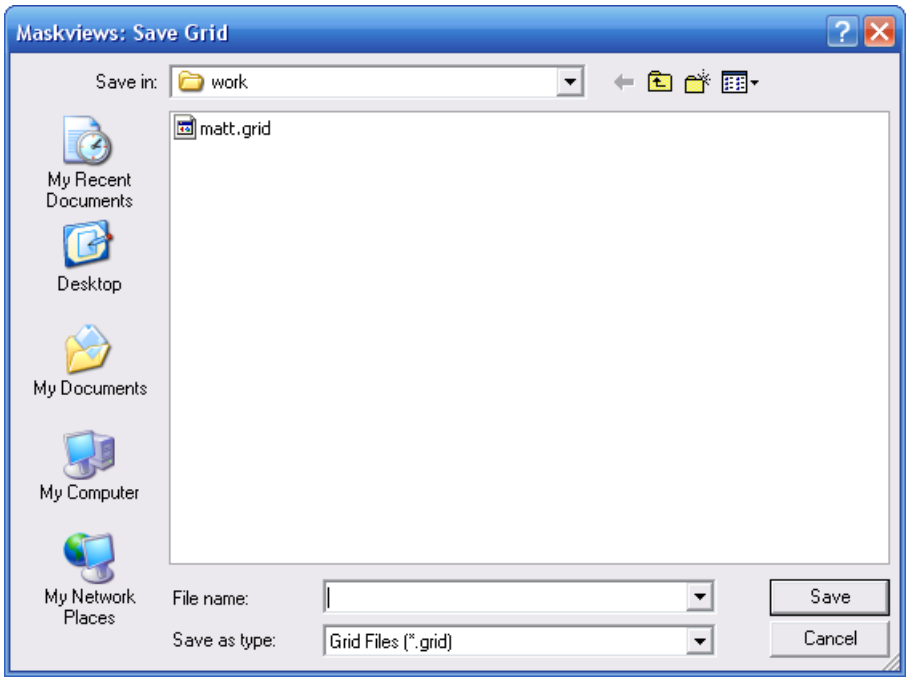

Figure 2-14: Save Grid dialog

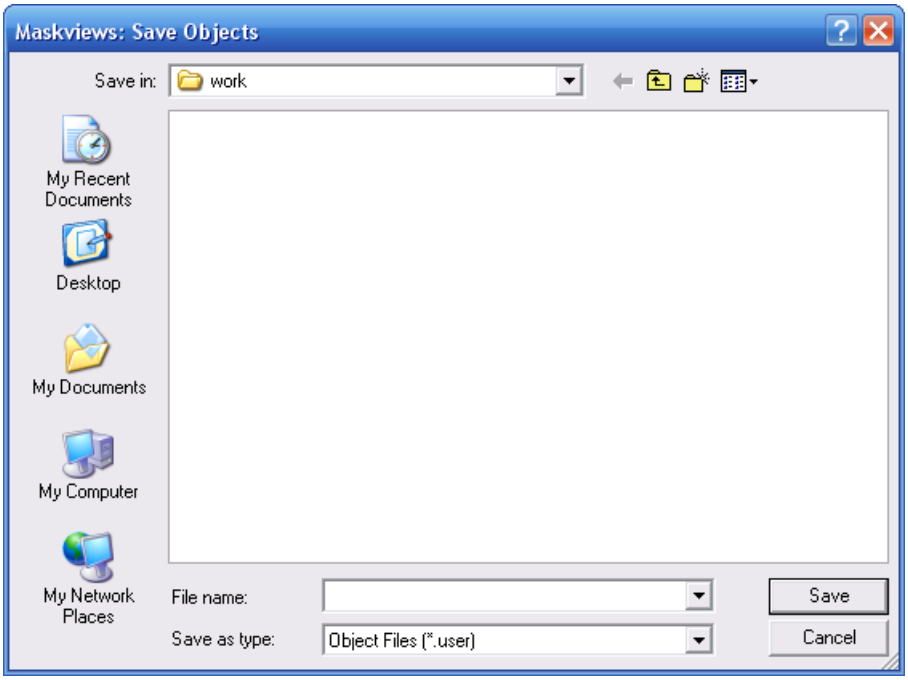

Figure 2-15: Save Objects dialog

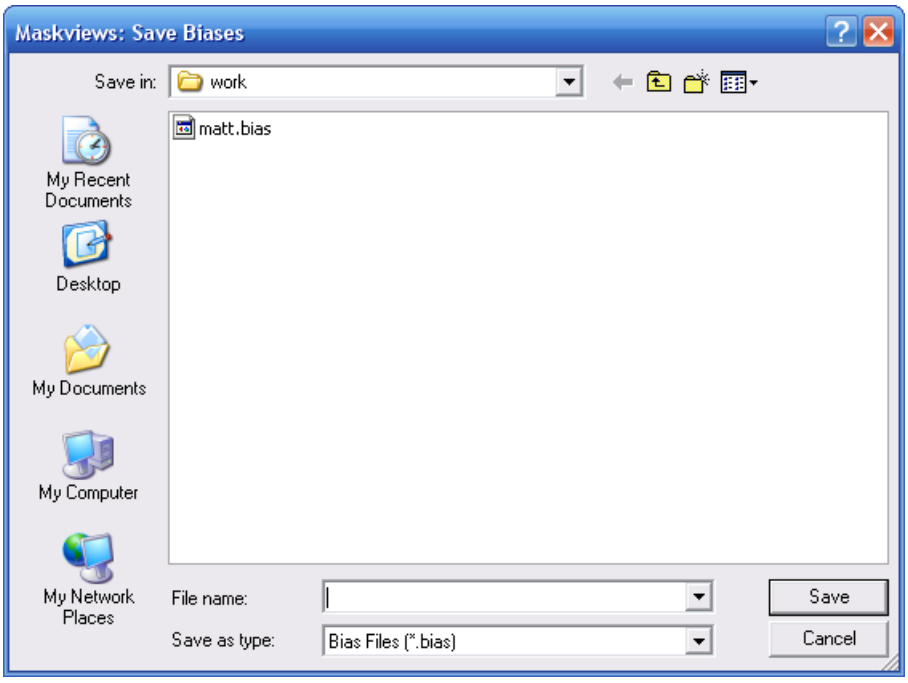

Figure 2-16: Save Biases dialog

Warning messages appear if you perform a load operation when MASKVIEWS already contains information or perform a save operation to a file that already exists.

2.5.2: Viewing Cutline Files

Selecting **File→Cutlines...** displays a dialog that allows you to view previously saved ATHENA mode cutline files. Selecting a file in the scrolling list on the dialog and clicking on the **Open** button causes a line to be shown on the layout where the cross section was taken. If the **Cutline preview** preference has been set to **show masks also**, then a summary display of the masks contained in the file are also shown.

To view the cutline, it must be saved from the same layout name. If the names are not identical, the cutline view is not performed. No changes are taken into account that have been made to the layout since the cutline was saved. Editing on the layout screen is disabled, while the cutline view dialog is being displayed. Dismissing the dialog (use the **Cancel** button) re-enables edit mode again.

2.5.3: GDSII & CIF Import/Export

The GDSII stream (version 6.0) format is an industry standard file format for storing layout information in a file system. It provides a hierarchical system of libraries and layout structures which can contain embedded references to other layout structures. Elements in GDSII format are in terms of polygons or attributed sticks. MASKVIEWS can load individual or hierarchical structures from a GDSII file, converting all data to its internal polygon format. It can also save the current layout as a GDSII library cell and create new libraries within an existing GDSII file.

If you select **File→Import→GDS2 Stream Format...**, the GDSII stream format interface dialog (import/export) will appear (Figure 2-17). This dialog has three levels of operation: **Files**, **Libraries**, and **Structures**.

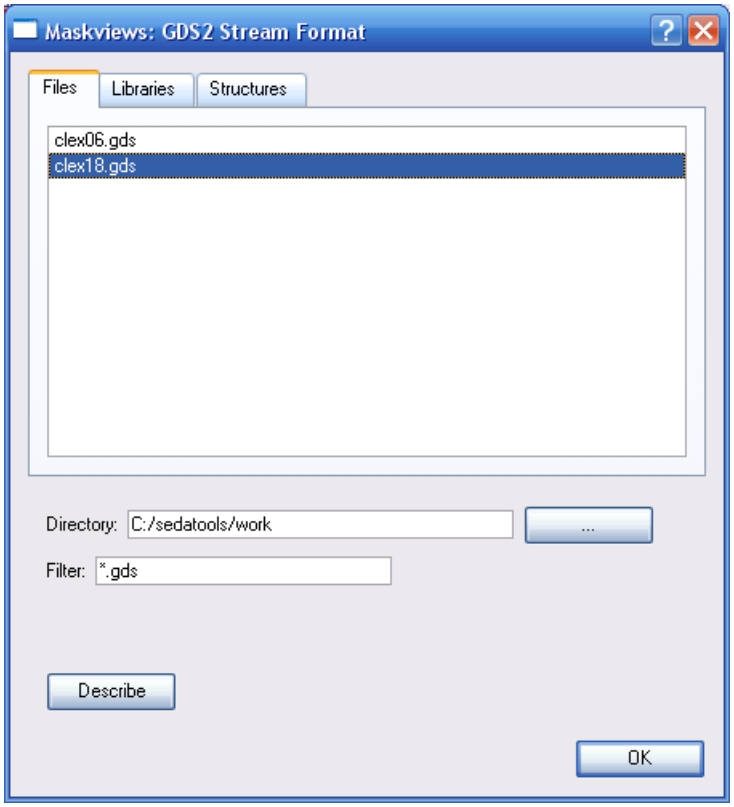

Figure 2-17: GDSII Stream Format Interface dialog

Under the **Files** mode, the list displays all files matching the **Filter** field in the directory defined in the **Directory** text field. Clicking on the **Describe** button with a GDSII file selected generates a dialog display describing information held in the file, such as the last access dates and the number of elements contained.

In the **Libraries** mode, all layout libraries in the selected file are displayed on the list. The current library is selected by choosing an item on this list. To generate new libraries, click on the **Create** button and enter a new name for the library in the **Name** field for the newly created item.

The **Structures** mode lists all of the layout structures in the currently selected library. Structures are loaded by selecting an item on the list and clicking on the **Load** button. The **Uncover sub-structures** option specifies whether MASKVIEWS should recursively load structures referenced within the selected structure (loading these may take a long time).

The **Offset x and y** fields allow loaded structures to be offset by the specified amounts. As elements are loaded if they have no stored phase or transmittance values, they are assigned the values currently set as the default phase and transmitter on the key panel. To set the offset, check the box. The default is no offset.

The current MASKVIEWS layout is saved to the library by clicking on the **Save** button. The newly created structure is named in the **Name** field, which may or may not be a currently existing structure name.

The minimum feature size that is resolvable with MASKVIEWS should not be less than 1/10,000 times smaller than the size of the whole GDSII structure. That is, structures imported into MASKVIEWS should typically be less than one millimeter along the longest edge.

Technology files are used to add names and other pertinent information to layout layers imported from GDSII files (in which layers are represented simply by their number). Selecting **File→Import GDS2 Technology files...** causes a File Loader dialog to appear, which allows the name of a technology file to be specified. The file specified here is then used with any GDSII read/write operation. The format of the files are lines of the format:

```
layer_number "layer_abbreviation" "layer_description"
```

When the GDSII structure is loaded, if any elements are found to exist on layer `layer_number`, then a layer with the corresponding name and description will be formed in MASKVIEWS. When a GDSII structure is saved, any elements existing of layers labelled `layer_abbreviation`, is assigned to the layer `layer_number`.

Note: Do not put the "#" sign before `layer_number` in the technology file.

CIF is another hierarchical file format for describing layout. You can import CIF files by selecting **File→Import CIF format...**. The File Loader will then appear. You can select the name of the CIF file here and load it by clicking on the **Open** button.

If you set the **CIF file preview** preference to **yes**, then a dialog will appear showing the first level hierarchy of the CIF file with numbered boxes, indicating the relative position of each structure. To descend into a structure, point to it with the mouse pointer and select the **Zoom in** menu option from the mouse menu. The sub-structures contained within the structure will then appear. If no substructures exist, then the display is blank. The path leading up to the current structure is displayed along the top of the dialog. The hierarchy can be ascended by selecting the **Zoom out** option from the mouse menu. Once the desired structure in the hierarchy has been reached, click on the **Load** button to load the data into MASKVIEWS.

2.5.4: Creating GDSII Stream Format

MASKVIEWS can create simple GDSII stream format. If you select **File→Save As...**, the Save As dialog will appear (Figure 2-18). Select **Gds2 File (*.gds)** for the save type. The dialog displays all files matching the **Filter** "`.gds`" in the directory defined in the directory text field. Choose a file name and click on **Save** and a GDSII stream format file will be saved.

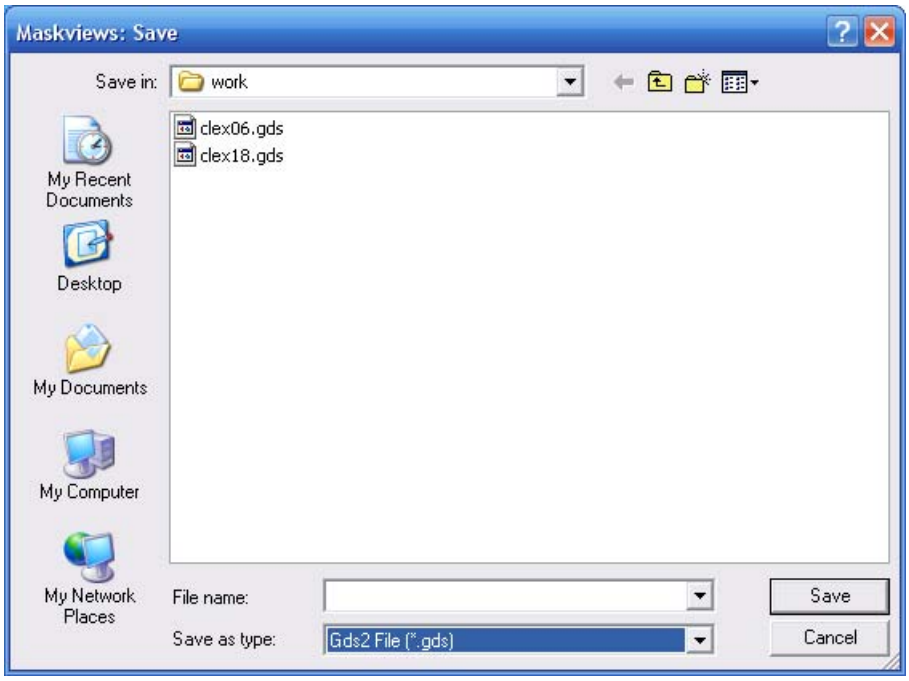

Figure 2-18: Save As Dialog

You can also load an existing GDSII file by selecting **Import**. You can then do some necessary editing such as adding labels and saving it to a new GDSII file by selecting **Save As→GDS2 format**. You can see these electrode labels from MASKVIEWS if you set the simulator to be CLEVER from the **Edit→Preferences...** menu.

2.5.5: Viewing OPTOLITH Image File

Selecting **File/import→OPTOLITH format...** opens a File Loader dialog that allows you to view an OPTOLITH `*.sec` file. When you select a valid file, clicking on the **Load** button superimposes the mask image contained in the OPTOLITH file over the top of the current layout. This option can be used to verify the mask image data being sent to OPTOLITH. It can also study the mask image produced by OPTOLITH as a result of an optical correction simulation.

Clicking on the **Cancel** button on the import dialog dismisses the dialog and removes the imported image from the layout area.

2.6: Utilities

2.6.1: Regions

Regions are used by DECKBUILD to define areas on IC layout where parameter extraction is to be performed. For example, if a cutline intersects the p-channel gate region, then the command

```
extract name=pxj Xj region = pgate
```

extracts the junction depth under the p-channel gate region.

Regions is a display mode used to view sections of the layout that correspond to boolean combinations of masks that are present or absent. An example of such for a CMOS layout would be an n-gate that could be defined as any layout area where WELL is absent and doping, oxide, and polysilicon are all present with no other masks having any effect. To enter **Region** mode, select **Regions** on the menu at the top of the key panel. All polygons are then drawn as outlines only with the color fill used to indicate any defined regions. The region key is displayed on the key panel. Regions are defined using the dialog displayed by selecting **Define→Regions...**.

The **Region** menu at the top of the dialog (Figure 2-19) is used to select one of the available regions for definition. The region is then activated/deactivated using the **on/off** selector and named in the **Title** field. The region mask sets are then defined in terms of **true/false/don't care** selectors displayed next to each layer name. Select **true** when a mask on the layer must be present. Select **false** when a mask must not be present. Select **don't care** to indicate the layout layer has no effect on the region. The **Refresh** button is used to refresh the display after a region has been defined. You can still perform polygon editing when in Region mode. All editing, however, is still performed in terms of layout layers and not as regions.

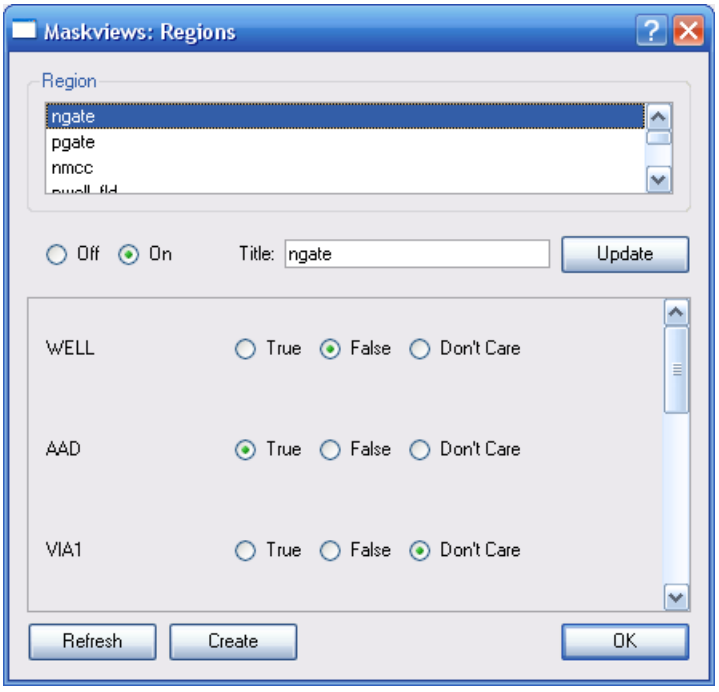

Figure 2-19: Regions Editor

The **Create** button at the foot of the dialog creates a new layer. This layer contains the objects formed by combining the other layers in the manner specified in the Regions dialog. The polygons on the new layer appear exactly as the shapes shown in the **Regions** view for the currently selected region. The new layer is named the same as the current region. An error is generated if that name is already in use. Objects created by intersecting named electrodes retain the name of any source electrode. If the object is formed by intersection of more than one named electrode, the name given to the created object is one of the names of the source objects.

Note: You must at least specify one layer as 'TRUE' in the Regions dialog to create a new layer.

2.6.2: Rescaling

Rescale is used to globally expand to shrink the whole IC layout to study the effect of larger or smaller circuits. Select **Options→Rescale layout...** to display Rescale dialog. This dialog has a field containing the rescale value. Rescale values of 1.0 cause no alteration in the layout. Values less than 1.0 cause the layout to shrink, values greater than 1.0 expand the layout. The circuit size can be returned to its original dimensions by another rescale with the **Rescale** value set to the reciprocal of the first. Click on the **Apply** button to apply your changes without dismissing the dialog. Click on the **OK** button to apply your changes and dismiss the dialog.

The rescaling dialog can also horizontally or vertically or both invert the whole layout. The options listed in the **Invert** field specifies which direction inversions are to be applied.

2.6.3: Zoom and Pan

Zoom and pan features are available by selecting **Options→Zoom & pan...**. A dialog is displayed (Figure 2-20) that shows the full IC layout with zoom factors across the bottom and pan **Nudge** buttons at the side.

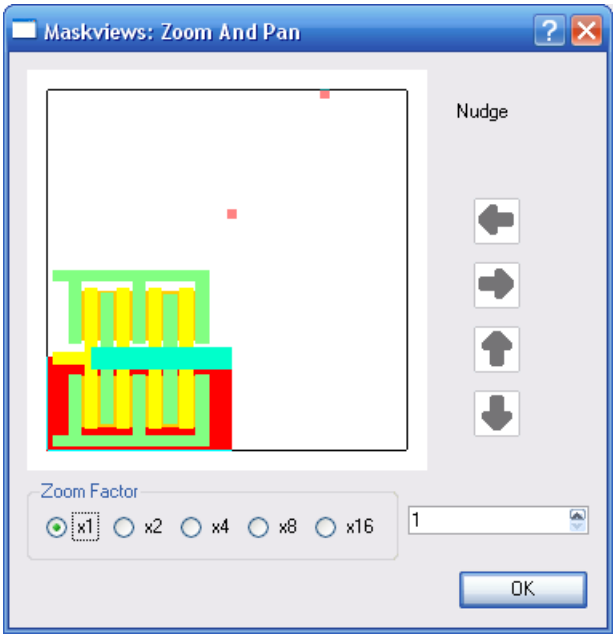

Figure 2-20: Zoom and Pan

Zoom is performed by selecting one of the zoom factors listed or specifying an amount in the numeric field. **X1** causes the whole layout to be displayed. The other options cause only part of the layout to be displayed but magnified. The layout region currently shown on the main display is outlined by a **View** box on the Zoom dialog. You can move this view box either by clicking one of the **Nudge** directional arrows to pan up, down, left, or right by approximately 5%, or by selecting a new lower left corner for the **View** box on the zoom display using the mouse pointer.

2.6.4: Reordering Layers

To reorder layers on a layout using the dialog displayed (Figure 2-21), select **Options→Order layers...**. This allows layers to be re-ordered, copied and deleted.

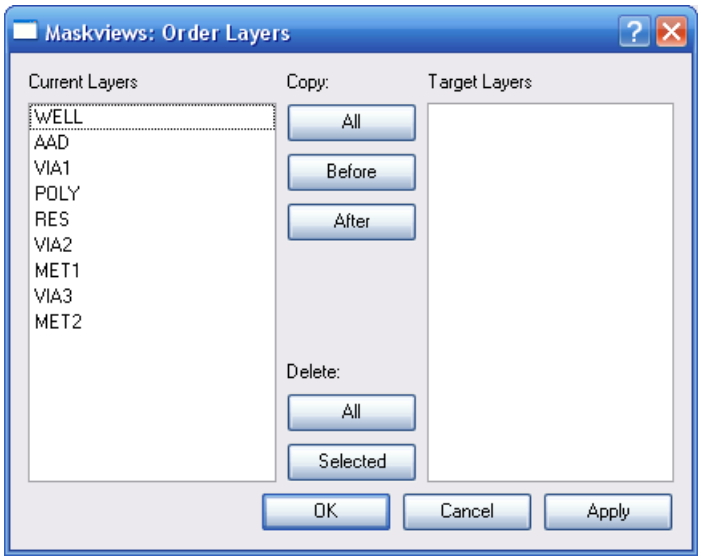

Figure 2-21: Order Layers dialog

This dialog has two scrolling lists.

- **Current layers** lists all layers as they currently are in the layout.
- **Target layers** lists the layers in the order they are intended to be. Layers are copied from the **Current** list to the **Target** list using the buttons listed under the **Copy** label.
- **All** copies all of the layers in the **current** list to the **target** list. Any layers previously in the **Target** list are removed.
- **Before** copies the layer name selected in the **Current** list to the position before the layer selected in the **Target** list.
- **After** copies layer name selected in the **Current** list to the position after layer selected in the **Target** list. Layers are deleted from the **target** list using the buttons listed under the **Delete** label.
- **All** deletes all items from the **Target** list.
- **Selected** deletes the currently selected layer in the **Target** list.

Once the layers in the target list have been defined as required, the new layer ordering is put into effect by clicking on the **Apply** button. Elements on layers that are not copied to the target list are deleted. A warning is then issued in such cases giving the chance to abort the reorder. If a layer appears more than once on the target list, then the elements on the layer are duplicated for all layers after the first occurrence. A message is issued if a layer appears more than once warning of such and giving the chance to abort the reorder.

Editing on the layout screen and some of the dialogs are disabled while the Order Layers dialog is displayed. Click on the **Done** button to dismiss dialog without making any changes by .

2.6.5: Printouts

Selecting **File→Print** produces hard copy printouts of the complete layout, zoomed region, and the most recent simulation mask set. The output consists of a large image of the current layout. A smaller image of the complete layout (if zoom is in operation) with arrows indicating what section of the whole the zoom region corresponds to and the most recent masks summary set if one has been produced. The layout images drawn are normally produced with the same display mode that is currently selected (i.e., **Layers**, **Phases**, or **Transmittances**). Region images, however, cannot be drawn and selecting **Print** while displaying regions have the same effect as printing layers.

2.6.6: On-Line Help

Selecting **Help→Maskviews Help...** displays the on-line manual. The on-line manual provides an in-depth description of the functions and operation of MASKVIEWS.

2.6.7: Release Documentation

Selecting **Help→About...** displays a dialog that shows the version number and release date of the installed program. Selecting the **More Details** button in the About dialog will show additional information about libraries that are linked with MASKVIEWS.

2.7: Preferences

2.7.1: Overview

MASKVIEWS has many preferences that you can customize. All of these can then be saved to a file and are recalled every time MASKVIEWS is started. To open the Preferences dialog, select **Edit→Preferences...**. There are several pages of preferences options in this dialog. To see these pages, click on the headings under the **Manage Preferences** on the left side of the dialog (see Figure 2-22).

2.7.2: Default Preferences

The **Defaults Preferences** section (Figure 2-22) allows you to change the default editing, operations, and setup preferences used by MASKVIEWS.

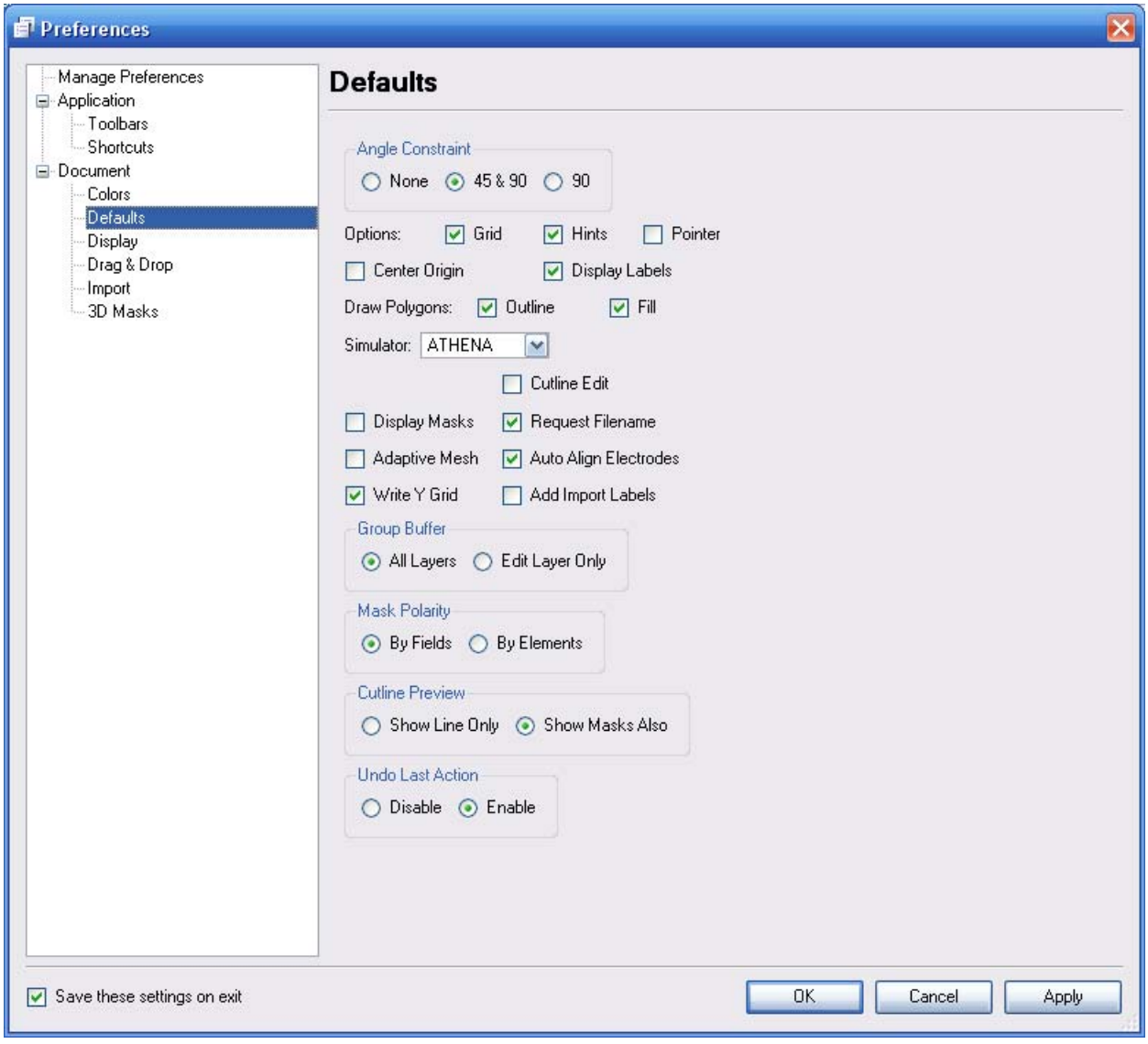

Figure 2-22: Defaults Preferences dialog

The following choices are available:

- **Angle constraint** limits how polygons sides and lines can be drawn. **None** allows any lines to be drawn. **45 & 90** allows only vertical, horizontal and diagonal lines to be drawn. **90** allows only vertical and horizontal lines.
- **Options — Grid** toggles the drawing of the layout space dashed grid lines. **Hints** toggles messages which may be displayed at the foot of the main screen. **Pointer** toggles the continuous display of the mouse pointer position at the foot of the key canvas.
- **Center origin** specifies whether the 0,0 point lies at the bottom left of the layout screen or in the center. This option may be automatically set by some of the simulator options.
- **Display labels** indicates whether the mask element labels are also displayed on the layout.
- **Display masks** enables/disables the summary display of the mask sets and grid preview generated when writing a simulator output file. If ATHENA is the target, the icon display choice allows you to alter the ratio of grid and mask display.
- **Simulator** defines the target simulator for MASKVIEWS.
- **Cutline edit** selects whether the ATHENA cutline can be moved before writing the output file.
- **Write y grid** enables/disables writing the ATHENA vertical grid information to the output file.
- **Group buffer** specifies whether the group cut and paste operations are performed on all edit layers at once or only on the current edit layer.
- **File loader** sets the option on the file loader dialogs to display only files matching the filter masks or also list all of the directories contained in the current directory.
- **Request filename** specifies whether a dialog will appear for each cutline that requires a filename.
- **Cutline/Grid preview** sets cutline display options. When you load a cutline file for viewing into MASKVIEWS and you set this option to **show line only**, then only a line on the layout will appear. If you set this option to **show masks also**, then the view also shows a mask summary display.
- **Mask polarity** specifies whether the dark/clear field of the **Layers** dialog refers to the opaque/clearness of the mask elements or the mask field. Changes made to mask polarity do not take effect until MASKVIEWS is restarted.
- **Undo last action** enables/disables the **undo** command on the main Edit menu. **Undo** is achieved by saving a temporary file between each edit action, which may not be desirable in mask editing if saving the whole layout requires too much time.

2.7.3: Display Preferences

The display preferences alter the physical layout of the main **MaskViews** screen (Figure 2-23).

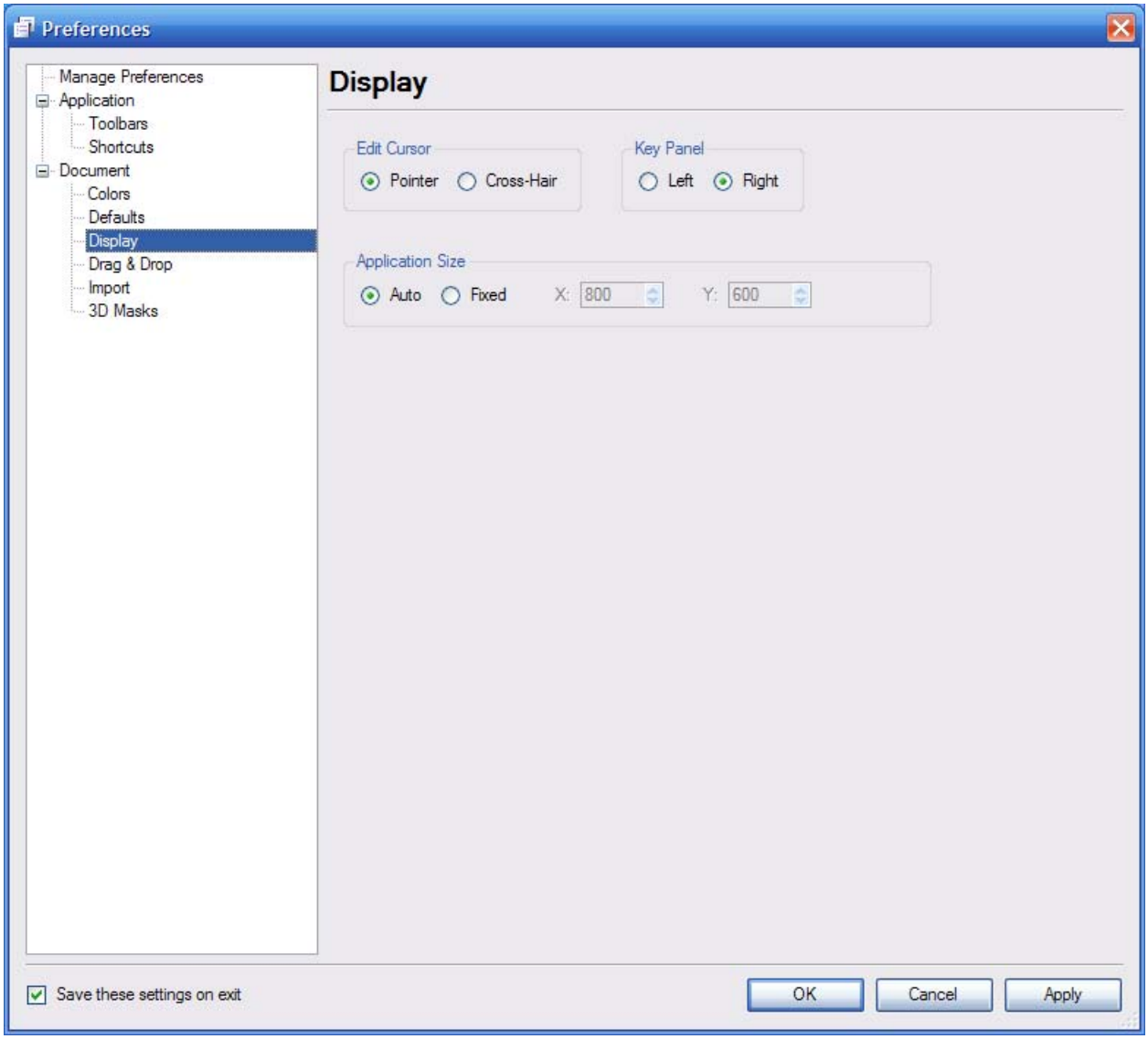

Figure 2-23: Display Preferences dialog

- **Edit cursor** specifies whether the window edit cursor is the standard pointer type or a transparent cross-hair type.
- **Key panel** specifies whether the key panel is displayed on the left or the right side of the layout window.
- **Application Size** controls the size of the MASKVIEWS application when started. If set to **Auto**, which is the default, MASKVIEWS will automatically save and restore the size of the application for you. Optionally, you can specify a fixed size for MASKVIEWS to always use when starting up.

2.7.4: 3D Mask Preferences

This category is used to customize the three dimensional mask summaries, which are displayed when 3D Process simulator output is generated by the ATLAS simulator (Figure 2-24).

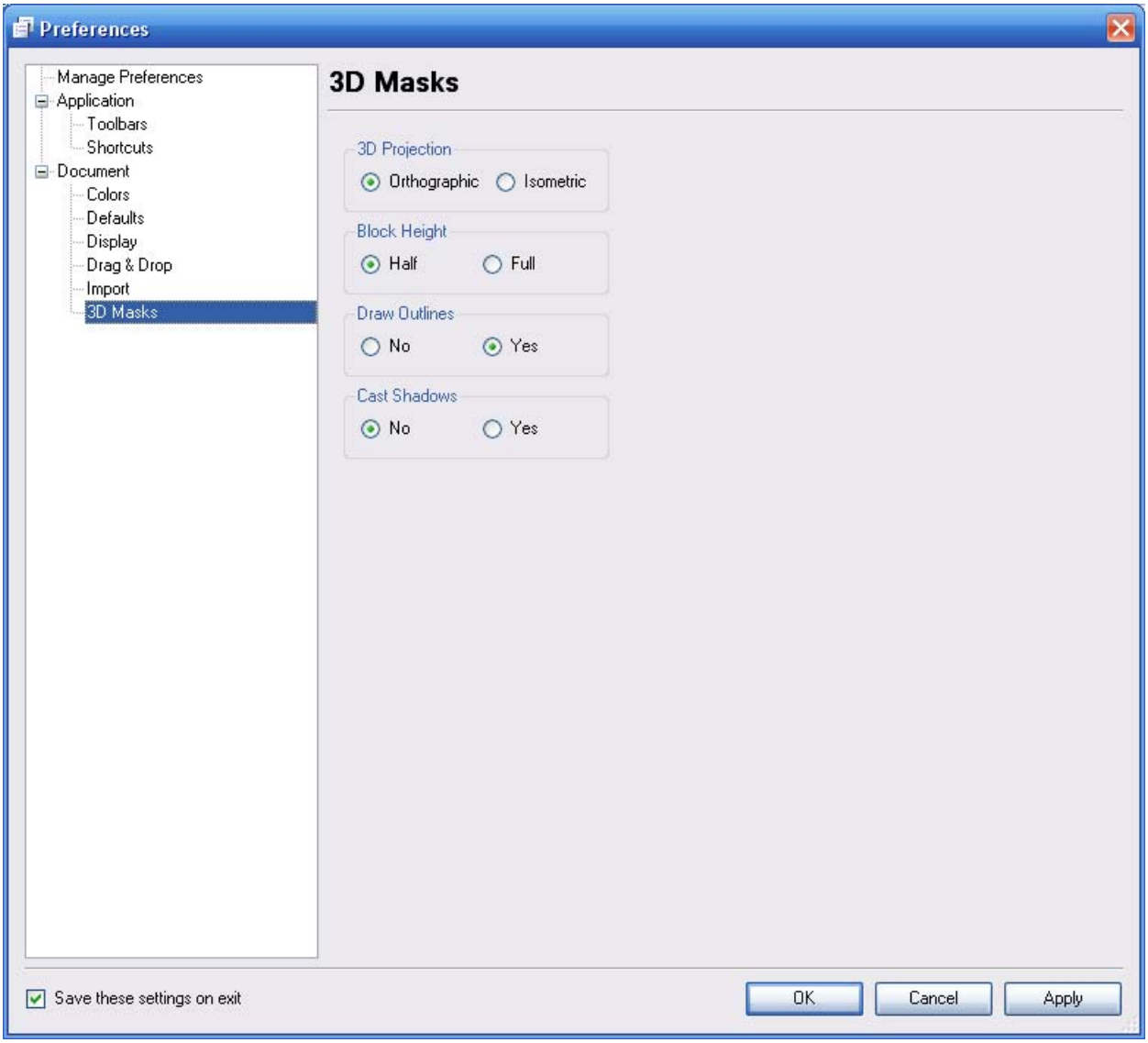

Figure 2-24: 3D Mask Preferences dialog

- **3D projection** indicates the type of draftsman's drawing functions used to convert the 3D models to 2D images.
- **Draw outlines** specifies whether outlines of all the masks displayed are visible through obscuring mask objects.
- **Block height** specifies that mask blocks drawn should completely extend vertically the space allocated to the layer, or only half of it.
- **Cast shadows** toggles the drawing functions that cause shadows from higher mask objects to be cast onto lower ones. Shadow drawing make take some time to calculate, so is not always desirable.

2.7.5: Drag and Drop Preferences

This category is used to define parameters used with the drag and drop abilities available in MASKVIEWS (Figure 2-25).

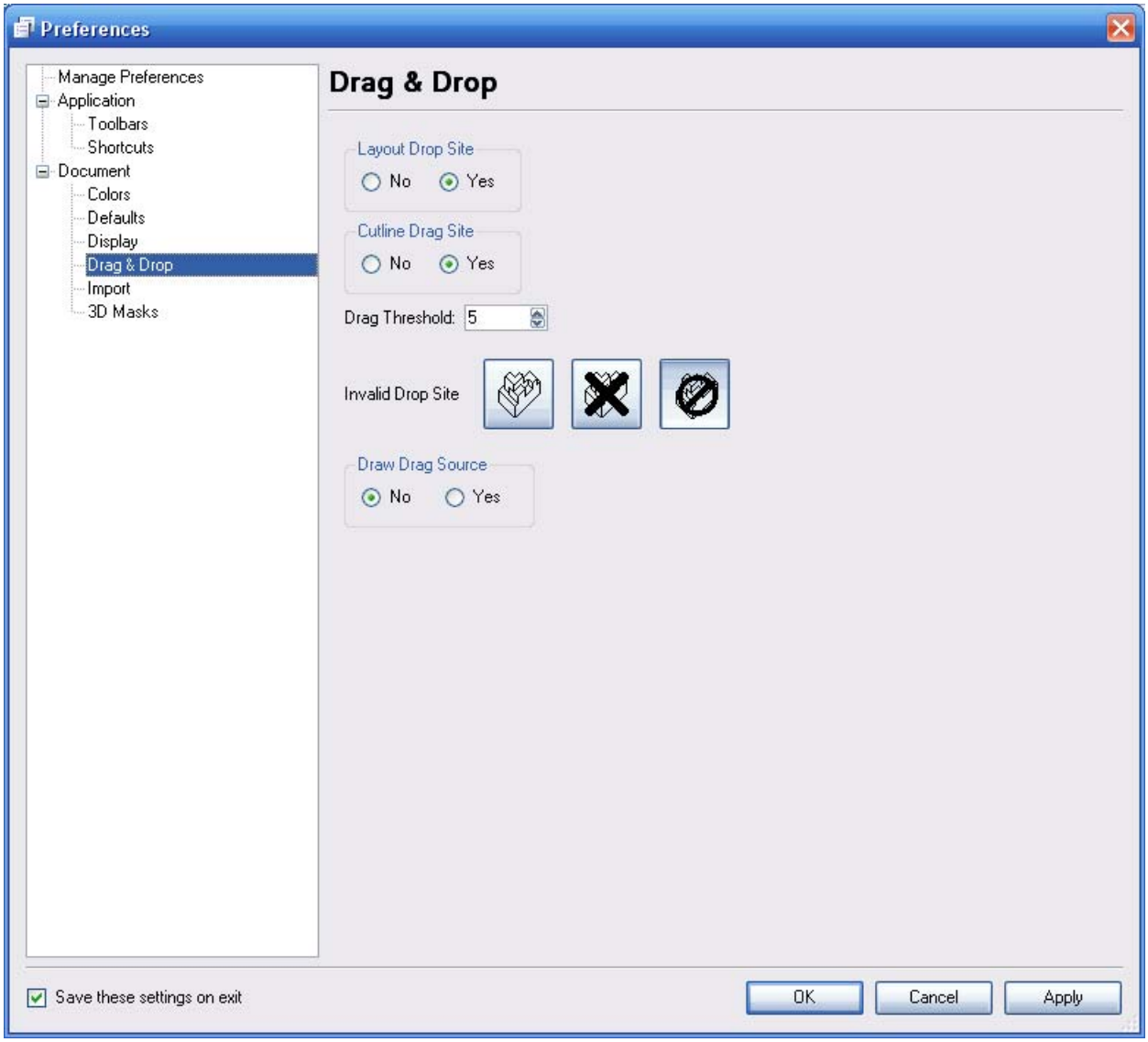

Figure 2-25: Drag and Drop Preferences dialog

- **Layout drop site** selects whether to drop layout information from the VWF onto MASKVIEW's main layout screen for loading.
- **Cutline drag site** specifies whether to drag cutline files from the summary displays to DECKBUILD.
- **Drag threshold** specifies the number of pixels the mouse pointer has to move with a button clicked before it registers as a drag.
- **Draw drag source** selects whether to draw a drag icon on each cross-section summary display.
- **Invalid drop site** displays the cursor image when the mouse pointer passes over a region where dragged data cannot be dropped.

2.7.6: Import Preferences

The import preferences are used (Figure 2-26) when importing and exporting GDSII structures to encode some of the attributes available in MASKVIEWS, which are not specifically catered for in the GDSII stream format description.

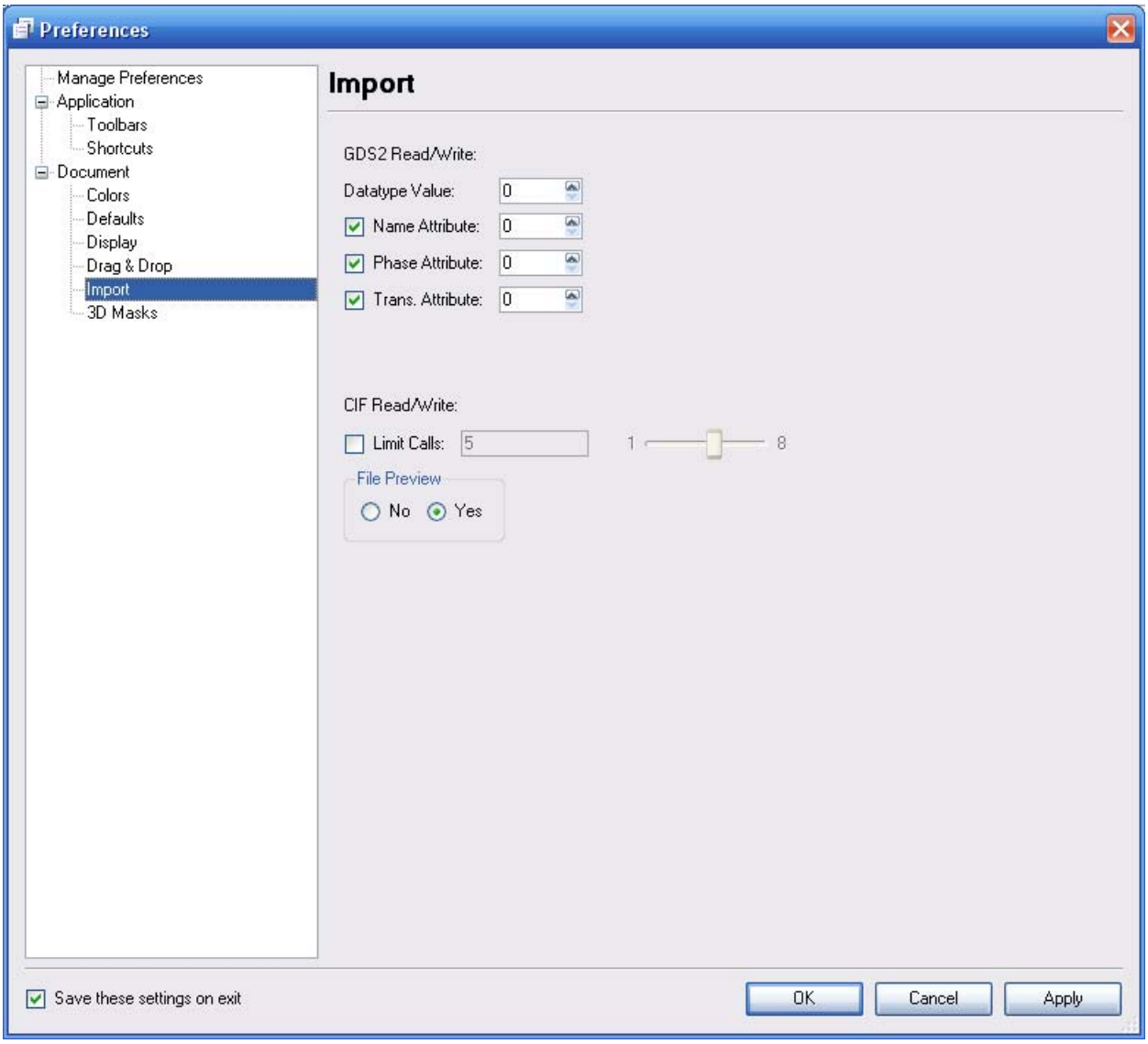

Figure 2-26: Import Preferences dialog

- **Datatype value** is the numeric attribute that will be written as the datatype of masks elements when exporting. **Datatype** is ignored on import.
- **Name attribute** specifies the `GDSII PROPATTR` tag number that is used to hold the mask labels.
- **Phase attribute** and **Trans. attribute** specify the `GDSII PROPATTR` tag numbers that are used to hold the mask phase and transmittance values.

You can disable all three attribute options for import/export using the check-boxes displayed alongside. There are two preferences that alter the way CIF format layouts are loaded: **Limit calls** and **File preview**. **Limit calls** defines how many substructure levels are descended when loading a CIF structure. A check box enables/disables the limit, and a slider allows you to define the limit. **File preview** selects whether to display the substructure previewer when you press the **CIF file Load** button.

2.7.7: Color Preferences

This preference section allows the colors used for each edit layer to be changed from their default values (Figure 2-27). The slider labelled **Number** is used to select a layer number whose colors are to be altered. The two fields update the color selections for the selected layer. **Borders/highlight** shows the color used to trace around the edge of each polygon on the layer. This is also the color used in illuminated sections of the 3D mask displays. **Fill/shadow** is the color used to fill each polygon on the layer. It is also the color used to indicate shadowed areas of masks on the 3D mask displays. **Foreground Color** and **Background Color** allow you to change the default colors that MASKVIEWS uses in its drawing. **Text Color** allows you to change the color of the text MASKVIEWS uses for its drawing, such as labels.

Note: Modifying the **Text Color** will not affect the color of the axes labels or title. Their color is controlled by the **Foreground Color**.

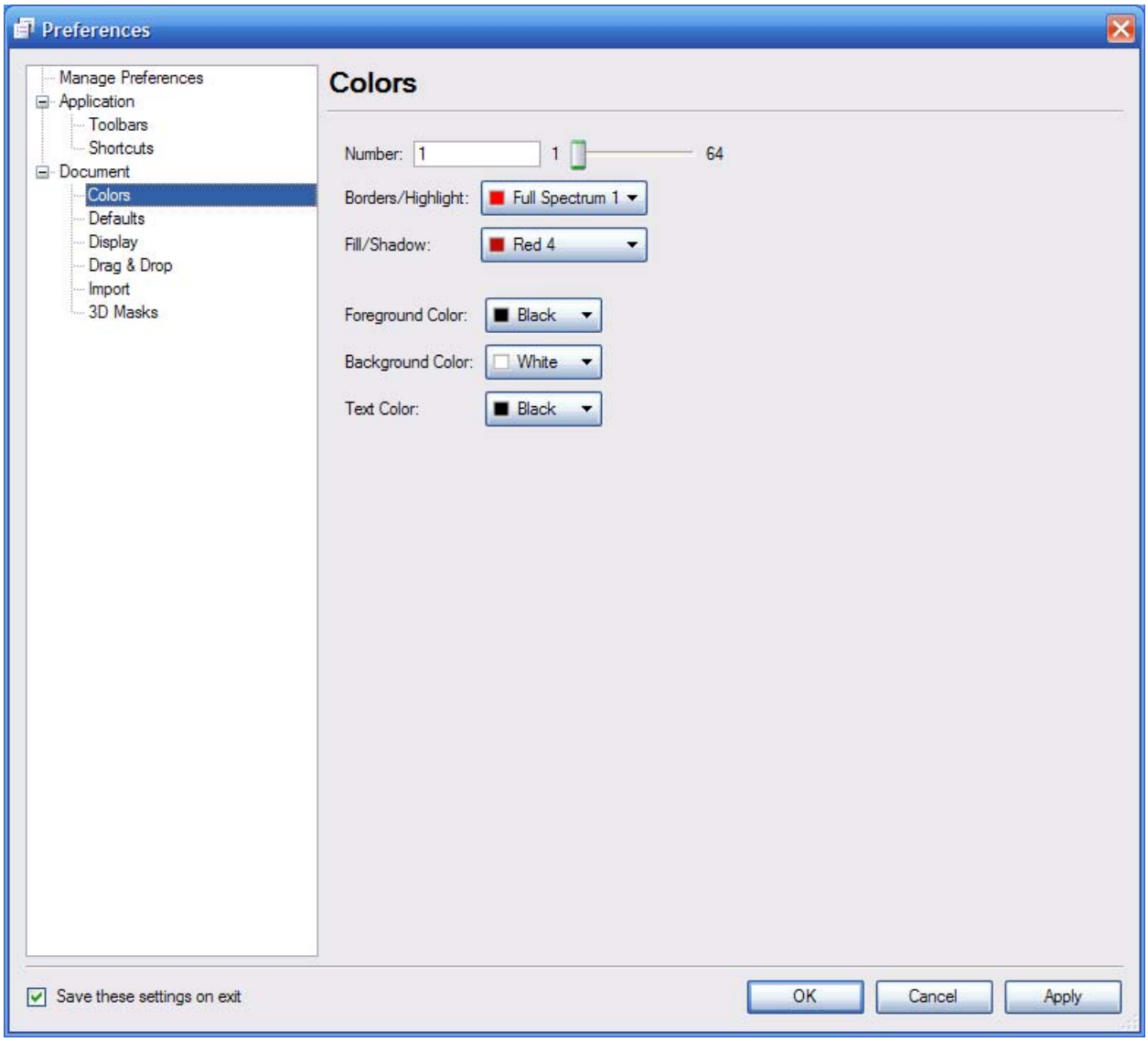

Figure 2-27: Color Preferences dialog

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